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REASONS FOR CONFIDENCE.

This country has passed through a severe and painful ordeal during the past fortnight in the assassination of President McKinley, whose death has left everywhere a sense of personal loss, so greatly was he admired and esteemed. At no time, however, did the feeling of consternation develop into panic, and now that Mr. McKinley's successor has been inducted into office, the great onward movement of national affairs has been quietly resumed. The firm condition of our financial markets is an evidence of the stability of things and of faith in the continuance of that prosperity which marked in general the whole period of Mr. McKinley's presidency. The foul murder by an anarchist of a man so universally beloved would have justified serious perturbation in trade and industry, but the very occurrence has only served to show how free our people, as a whole, are from acceptance of the villainous doctrines of those who see in social chaos a regeneration of mankind. And yet heaven knows how sedulously the yellow press for years past has been preaching discontent, hatred of wealth, dislike of work, enmity toward corporations, and particular distrust of Mr. McKinley as an alleged "tool of the trusts." It has been sickening the past week to see how the same papers, realizing at last how utterly out of touch they are with real American sentiment, have turned around and tried to square themselves by representing the martyred President as little short of an archangel.

President Roosevelt has already declared his intention to maintain and carry on the policy of Mr. McKinley, and this is in itself another reason for public confidence. That policy found its last expression in Mr. McKinley's speech, made at the Pan-American the day before he was shot, and in that broad, statesmanlike utterance was embodied the larger programme of trade, shipping and international relationships, which may be summed up in the two ideas of peaceful imperialism and progressive reciprocity. In Mr. Roosevelt we have a man of the highest character, lofty courage, extensive culture, and a capacity of intellectual growth—in short, all the qualities that afford bright auguries for his administration. The very impetuosity that has carried him far now becomes a pledge of vigor and efficiency in every governmental department; for no President yet had too much energy and activity for all the multitudinous duties and responsibilities of his great office.

President Roosevelt begins his administration at a time when the country under Mr. McKinley's beneficent rule has enjoyed several years of prosperity, and there are pessimists who hold that "good times" cannot go on forever. On the other hand, it might be fairly asserted that the tide of prosperity has had at least two ebbs even under Mr. McKinley, but that progress goes on all the time. Since 1896, moreover, agencies have been set in motion for the development of the resources of this country, which will be long in exhausting their possibilities, and it is certain that under Mr. Roosevelt we shall all lead the "strenuous life" that lifts nations from higher to higher spheres of influence and success.

THE TELEPHONE IN DIPLOMACY.

In regard to the recent extension of long-distance telephone lines in Europe, the *New York Times* makes the interesting suggestion that a good deal of international misapprehension might be avoided if diplomats would resort to the telephone. As it says: "It involves no stretch of the imagination which taxes its elasticity to fancy the

German Chancellor calling up the French Minister of Foreign Affairs to get knowledge of some matter which can be explained in three minutes to the satisfaction of both. Verbal communications are likely to be much more frank and confidential than letters can safely be, since they cannot be subsequently referred to or verified by the production of the manuscript. While the telephone may not be suitable for the discussion of grave questions of state on which the fate of nations depends, it may very well tend to keep out of that classification a thousand minor matters which are exaggerated by formal treatment and become 'significant' without really having any significance." There is something in this, but the difficulty will always exist that diplomacy must be "documented." Without the "papers in the case," little will be done. In addition there is the fact that international intercourse by wire is largely done in code, and that applied to conversation is out of the question. Besides, Prince Bismarck once made the objection to the use of the submarine cable in international disputes, that it prevented diplomacy from being "unctuous." Coming from the diplomat of "blood and iron," that criticism sounded rather funny.

Switchboard Manufacture in England.

Our English cousins recently received another rude reminder of their subordinate position in the field of electrical manufacture, this time through the result of a competition for the supply of a switchboard to a Manchester lighting station. Twenty bids were tendered for the work, of which only two were from English manufacturers, and the lowest English tender was almost $100,000 higher than that of the successful bidder, which was about $200,000. The order went to a German manufacturer, and it may be added that the next lowest bid was from a firm that would have procured the switchboard from this country. Commenting upon the condition of English electrical manufacturing, which the above result implies, our London contemporary, the *Electrician*, says it seems incredible that the makers of switchboards in England should have been left behind as they were, and that several of the British firms should not have been equal to the occasion. To us, on the other hand, it seems clear that the cause of unreadiness recently displayed by English manufacturers to meet present home conditions in electrical development is to be ascribed to the manner in which the electric light and railway industry in Great Britain has in the past been trammeled by governmental regulation and a municipal dog-in-the-manger policy, which naturally has prevented manufacturing development. With our three thousand central stations and one thousand electric railways, as a market, electrical manufacturing in this country has happily been subjected to quite opposite conditions.

200-Volt Incandescent Lamps.

Steady improvements in the manufacture of high-voltage incandescent lamps have taken place during the last few years, with, of course, corresponding improvements in the manufacture of lamps for ordinary pressures. The result is that 235-volt lamps are now obtainable with an initial economy of 3.4 watts per candle. These lamps have two distinct spheres of usefulness. In the first place, they enable the installation of copper to be reduced in large two-wire isolated plants, such as hotels and office buildings. They also enable three-wire direct-current systems to be operated at double pressure, and double radius of economic distribution. The disadvantages are a reduced economy, and the somewhat greater cost of the lamps themselves, together with the relinquishment of all 8-cp lamps in favor of 16-cp lamps. In connection with alternating-current systems of lamp distribution, there seems to be less advantage in using the lamps of higher pressure, since the use of transformers enables the amount of secondary copper to be kept within relatively small expenditure. There can be no question of the advantage and economy of using the higher pressure lamp in new direct-current three-wire systems, with overhead transmission wires, supplying a scattered suburban area. In large cities, however, in which direct-current three-wire systems of 120-volt pressure on a side have come into long established use, the cost of changing lamps, fixtures and apparatus from 120 to 240 volts is so considerable, that it is doubtful if the high-pressure lamp can gain entrance.

Motor Generators versus Converters.

An article appears in this issue upon a question of considerable practical importance, and one which elicits much difference of opinion. It is now a well established fact that the alternating-current system must be employed for long-distance transmission of electric power. On the other hand, many distributing systems, and in particular street railway systems, insist upon being supplied with direct currents. The consequence is that somewhere between the transmission line and the translating device, there must be machinery for converting alternating into direct currents. Of course, the simplest way of meeting the difficulty in theory would be to eliminate all direct-current machinery, and employ an alternating system from generator to motor, thereby dispensing with the apparatus for conversion. But at the present day we have to meet a condition and not a theory, so that converting machinery must be employed. There are two solutions of the problem, each having its devotees. One is to employ alternating-current motors coupled to direct-current generators, and the other is to employ converters. Motor-generators are almost exclusively employed in Europe, converters being rare, and when employed, almost invariably of American manufacture. In this country converters are the rule for railway work, motor-generators being sometimes employed for lighting.

The argument in favor of the converter is that it replaces two machines, i. e., a motor and a generator, by a single machine, and that the efficiency is greater on this account; also, that by properly proportioning the apparatus and system, the converter may be virtually compounded, so as to maintain a nearly constant potential difference at the terminals of the translating devices, in spite of variations of load. The argument made by the motor-generator advocates is that the apparatus is simpler and more readily controlled; that it is less liable to injury or break down, and that the secondary pressure may be manually regulated within a range far greater than that which the converter will permit. As regards the charge of inefficiency, they say that with moderate primary pressures a synchronous motor can be operated directly from the line, without the insertion of transformers; whereas, the pressure relations of a converter are such that step-down transformers almost invariably have to be inserted between the transmission line and the converter. They claim that after the losses in these transformers are taken into account the efficiency of the motor-generator is but little less than that of the converter, and that this disadvantage is more than made up by advantages in regulation and simplicity.

The article on a following page is written from the standpoint of motor-generator advocates. It shows that in sizes of 350 kilowatts, the joint full-load efficiency of the two machines is about 90 per cent. That is to say, about 5 per cent is lost in the alternating-current motor, and 5 per cent in the direct-current generator, at full load. At half-load they indicate 7 per cent loss in each component machine, or about 86 per cent joint efficiency. With this is a low full-load temperature elevation, the loss being distributed over the surfaces of two machines. The table of comparison contrasts the above results with some particular converters whose manufacturer is not

mentioned, and in which it would seem that the full-load loss is 7 per cent in the converter, and 3 per cent in the transformer, making the combined converter efficiency about 90 per cent, or no better than that of the motor-generators. We think that these figures do not represent the best practice, and that it would be quite commercial to have 350-kw converters with 5 per cent loss, and transformers with 2.5 per cent loss at full load, representing a joint efficiency of about 92.5 per cent, or a gain of 2.5 per cent efficiency over motor-generators. We think, therefore, that the argument in the article is somewhat strained in favor of the motor-generator.

It would seem that in this controversy no fixed rule can be laid down in favor of one side or the other. When, however, the distributed pressure does not require close regulation, as, for example, in the case of street railways, the advantages seem to lie on the side of converters, which are about 20 per cent cheaper than motor-generators, after allowing for the transformers and accessories, and which show a distinct saving of from 2 to 7 per cent in power, according to local conditions. On the other hand, where the distributed pressure has to be closely maintained, as in incandescent lighting systems, it would appear that motor-generators are often to be preferred, an attendant's services being, however, required for controlling the generator pressure. In such installations there is certainly less liability to accidental crosses between the high-tension primary and the low-tension secondary systems, through the transforming apparatus.

THE NERNST LAMP.

The paper read at Buffalo by Mr. Wurts and the resulting discussion furnishes considerable food for reflection. There seems to be a striking difference between the Nernst lamp of the newspapers and of foreign prospectuses and the lamp actually developed by Mr. Wurts and his associates. These gentlemen are wont to make a pretty thorough job of their undertakings, and it is perfectly safe to assume that their product is as good as, or probably better than, anything else abroad which has been developed there along the same line. The Nernst lamp of the newspapers was a simple and beautiful thing far more efficient than the ordinary incandescent, lending itself with peculiar facility to distribution at high voltages, and altogether revolutionary in its properties. The Nernst lamp as disclosed in Mr. Wurts' paper is not in any apparent sense a direct competitor of the incandescent lamp, but rather occupies a distinct place between it and the arc lamp, which latter illuminant it can also evidently push pretty hard in the race for supremacy. The smallest Nernst lamp standardized appears to be of 50 candle-power, and this is admittedly inferior in efficiency to the larger lamps with multiple glowers. The objections to the new lamp raised in the discussion seem to us, therefore, rather founded on a misconception of its probable function. For an incandescent lamp it is undeniably highly complicated, but as compared with the mechanism of an arc lamp it is extremely simple. Again, the ordinary incandescent lamp requires no ballast, although if one were working for maximum efficiency it might conceivably prove useful, while the arc lamp practically does require ballast, although not for the precise purpose for which it is used in the Nernst lamp.

The "bugs" in the Nernst lamp seem to be three: First, the ballast, which reduces the working efficiency; second, the heater, which is one more rather delicate element to replace, and, third, the blackening of the globe, which is practically more serious than either of the other faults. It is this which really places the lamp in the arc light category, compelling periodical attention and forbidding therefore its installation in inaccessible places. The life of the glower seems reasonably good—very good, if new glowers can be cheaply supplied. The efficiency of the lamp is less than the early foreign reports would suggest—a little better than that of an ordinary incandescent, considering the drop in the efficiency of the latter during service, but scarcely so good as that of a first-class direct-current enclosed arc. The distribution is peculiar—from a single glower a cylindrical distribution, varied in the larger lamps by the arrangement of the glowers. The net result is a spherical efficiency little if at all higher than that of a first-class incandescent, and a hemispherical efficiency about equal to that of an enclosed arc or an incandescent with a well-arranged reflector. As to quality of light, the lamp seems to leave little to be desired. Its illumination is white and steady and free from shadows, surpassing, on the whole, either arc or incandescent. This advantage would give it a sufficient reason for existence if it had no other. Of course, for many purposes the advantage in color over the ordinary incandescent would more than make up for many failings, while steadiness cannot be yet reckoned among the chief virtues of arcs. If the Nernst lamp could be conveniently made of small candle-power, say, 16 to 20, it would intrude at once on the domain of the incandescent, but there are apparently difficulties in the way, and the attention required by the globes is a serious matter when one goes into small sizes that must be used in considerable numbers. Moreover, the present tendency is toward more thorough sub-division of the illumination than heretofore.

From the standpoint of the central station, the Nernst lamp presents an interesting problem. So far as the supply of energy goes the absolute amount required does not materially differ from that demanded by our present arcs and incandescents. The supply can be at 220 volts or thereabouts, which is a decided advantage, the lamp being, too, on a better plane of efficiency than the 220-volt incandescent. On the other hand, the new lamp requires practically about the same care as an arc, which will militate against its use in small sizes, and will demand the services of about the same number of trimmers as would be required for an equal number of arcs. No carbons have to be provided for the Nernst lamps, but the glowers must be replaced at about every eighth inspection. The price of a set of a half-dozen glowers has apparently not yet been fixed, but it must evidently, taking due account of rebates for parts returned, be low unless the up-keep of the lamp is to exceed that of an enclosed arc.

From the present outlook the alternating current is required for successful operation of the new illuminant, and obviously, if the lamp takes an important place in the art, there may be a considerable shake-up in central station equipment. With the present lack of data based on practical operation on a large scale it is very difficult to place a just value on the Nernst lamp. We should imagine that its first use would be the replacement of constant-potential alternating arc lamps on a scale depending on the outcome of further experience. It is at least equally efficient, is noiseless and is free from flickering or shadows, besides giving a whiter light than the enclosed arc, and these virtues should give it a powerful impetus. Its steadiness and conspicuously better light than the four and five-ampere enclosed arcs of any kind ought to give it a right to respectful consideration even as against direct-current arcs, but we are disposed to think its first function will be constructive rather than destructive. Within its presumable limitations, if it but fulfils the promise of the present, it yet is likely to influence powerfully the organization of future distribution systems. In other words, although the Nernst lamp is as yet untried on a commercial scale, and while its field is restricted by certain present faults, it is a factor that cannot safely be neglected in estimating the development of electric illumination and the future methods of electrical distribution.

The Automobile Run.

Owing to the death of President McKinley, the endurance test of automobiles from New York to Buffalo, of the Automobile Club of America was called off at Rochester, 394 miles, and the Erie-Buffalo sports this week have been abandoned. Of the 80 starters, 41 reached Rochester, 27 of which were gasoline and 14 steam. The weather was bad and the roads were wretched, being chiefly samples of stone quarry and sand pit. The wonder is so many got so far.

Telephony in the Cities.

Some statistics emanating from Boston go to show that in point of telephone development, San Francisco towers above the rest of the cities with a telephone for every 16 of its population. Estimating 5 persons to a family, every third family has a telephone. Boston takes second place in this development, with a telephone for every 24 inhabitants, or one telephone for every five families. Philadelphia shows the largest relative gain in the number of telephones in use, with an increase of 63 per cent over the year ended Dec. 31, 1899, Louisville coming next in the order with a gain of 43 per cent. The number of calls per subscriber is not given, however. The telephone situation in some of the larger cities in the United States is given as follows:

City.	Telephones, Dec. 31, 1899.	Dec. 31, 1900.	Per cent of.	Population census 1900.	Population per telephone.
New York (all boroughs)	53,128	70,870	33.	3,437,202	48
Buffalo	5,107	6,639	30.	352,219	53
San Francisco	16,817	21,324	27.	342,782	16
Boston	19,905	23,780	19.	560,892	24
Minneapolis	6,210	8,038	29.	202,718	25
Cleveland	13,158	14,570	11.	381,768	26
Detroit	7,434	10,190	37.	285,704	28
Milwaukee	6,893	8,492	23.	285,315	33
Pittsburg	7,409	9,129	24.	321,616	35
Cincinnati	7,161	9,142	28.	325,902	35
Louisville	3,539	5,049	43.	204,731	41
Newark	3,701	4,434	19.	246,070	55
Washington	3,278	4,650	42.	278,718	60
Chicago	21,237	27,734	31.	1,698,575	61
New Orleans	3,274	4,415	35.	287,104	65
St. Louis	6,369	7,512	18.	575,238	76
Baltimore	5,340	6,250	17.	508,957	81
Brooklyn	10,379	13,366	28.	1,166,582	87
Philadelphia	8,268	13,451	63.	1,293,697	96
Jersey City	1,607	1,906	18.	206,433	108

Electrical Engineers of the Day—XII.

W. S. Barstow.

In the last issue of this journal reference was made to the fact that Mr. W. S. Barstow had added his name to the growing list of consulting electrical engineers—that list which in itself is a striking indication of the maturity of the profession, although it by no means follows that the quality of merit throughout the list is uniform. Some men are born critics, others are born creators. It has been noted in literary work that the smartest critics have now and then written the worst books; in artistic life, that the poorest daubs have come from those who saw little to praise in a Sargent, a Landseer or a Meissonier. To combine the constructive or executive with the critical faculty is indeed rare, but Mr. Barstow has not only had to create central stations, but carry on their business, and has also had many a time already to pass judgment on the work of his fellow engineers in the same field. Indeed, it might well be claimed as to the engineering profession that it demands in its exemplars this combination of abilities or qualities.

After graduating from Columbia University in 1887, Mr. Barstow had the good fortune to enter the Edison Machine Works and to be brought in close touch with Mr. Edison. That worthy genius has a rather unflattering reputation for using men up. He not only takes out of them the best they have, but requires it twenty-six hours a day. To survive such an ordeal is in itself a testimonial to physique and intellect, while there are the compensations that come from sharing the ideas and aims of a leader among men, who works shoulder to shoulder with his associates. None the worse for this test, Mr. Barstow became associated with the Brooklyn Edison Company in its formative days, and as engineer and general manager contributed perhaps more than any other man to its brilliant growth and steady success. It is a trouble with many people that they can only hold one idea, and that while that idea lasts them for a lifetime, the great world has meantime been pushing along to larger and fuller notions of things. Mr. Barstow was not like an indurated direct-current, constant-potential man, who thought that electricity stopped when Edison hit on 110 volts, nor like the old arc-lighting men tied up forever to shoestring circuits. He saw the possibilities in electric power; developed the feasibility of running arcs and incandescents together; put his wires underground; and when the alternating current escaped from its single-phase restrictions, he saw swiftly the opportunity to enlarge the area of supply from a city central station, while none the less was he quick to adopt the storage battery for its reservoir and balancing capacity. Here was keen intuition and a progressive spirit, to whose advance the commercial and financial growth and the later consolidation of

the Brooklyn Edison system into the Kings County Gas, Electric Light & Power Company was at once incidental and inevitable. If anything, Mr. Barstow's engineering genius had easier play when working over a territory of a hundred square miles than when cooped up to the condition of ten blocks around Brooklyn City Hall. Thus, too, the problems of supplying current to the mighty congeries of Brooklyn street railways as well as to motors in a Myrtle Avenue coffee store or lights in a Fulton Street restaurant, were to him in the nature of a quite proper and feasible evolution.

Not wholly absorbed in the duties of his daily life, Mr. Barstow has long been prominent in the affairs of the Association of Edison Illuminating Companies, but his best known work on behalf of the profession as a whole has been done for the American Institute of Electrical Engineers, of whose council he is a member, his term as manager expiring in 1903. It was under his direction as chairman of the Papers and Meetings Committee that the remarkably successful conversazione was held this spring at Columbia University, and that all the arrangements were made and carried out for the Buffalo convention, just over, and the reception of the Institute's foreign guests. Mr. Barstow has also taken an active interest in the affairs of the Brooklyn Institute as chairman of its electrical section. All this, while indicative of disinterested willingness to work for the common good does not exhaust the range of his activities, for Mr. Barstow has made several useful inventions and was one of the first Americans to invest in Cuba, when that island became an American sub-station.

High-Speed Electric Railway Car of the Allgemeine Elektricitats Gesellschaft, Berlin—II.

By O. Lasche.

(Chief Engineer Allgemeine Elektricitats Gesellschaft.)

(Concluded.)

COLLECTOR BOWS.

THE current is led to the three vertically superposed wires, from which it is taken into the car through bow-shaped collectors. By this system of taking off the current any deflections of the working wire between the connecting points does not affect the bow, a jumping of the latter being less likely than if it has contact from below. Notwithstanding this fact, the question of the collectors had to be very carefully studied, and although the requirements of the work to be effected at a speed of 50-60 meters (164 to 196 ft.) per second could only be very incompletely complied with, an experimental arrangement was nevertheless made.

At both ends of the car (Fig. 1) the three arms are arranged on

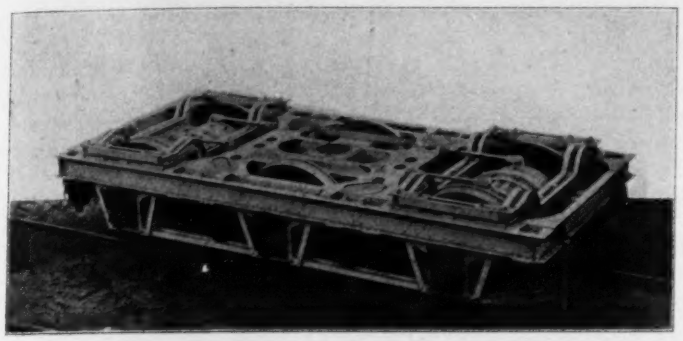

FIG. 5.—ONE OF THE TRUCKS.

the roof for the three different phases. The distance between the arms is determined by the space required by the bows to turn round their vertical axes. These distances are, however, kept as small as possible, and the arms are located close to the pivots of the bogies with a view to avoiding in the curves any material change in the distance up to the overhead wires. Two systems of bows were considered necessary, so that in the event of one failing to act, no sparking is produced, but the current is taken from the other bow.

This endeavor to increase the number of contact surfaces was carried still further with a view to reducing to a minimum the weight of the parts which slide along the wires. A number of aluminum bows were connected by plate springs of different length to the arm itself. This elastic arrangement was to ensure a first rate

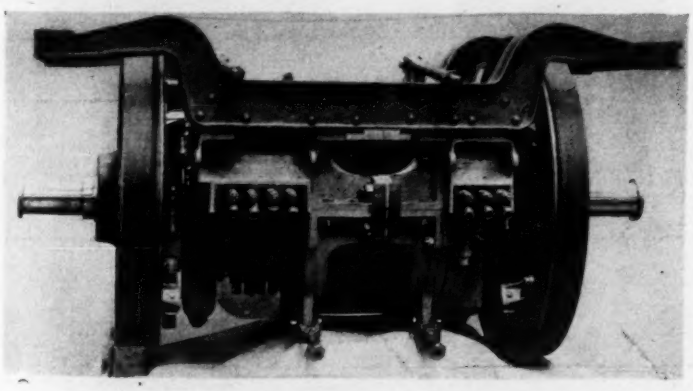

FIG. 6.—MOTOR MOUNTED ON AXLE.

permanent bearing action, and in the event of one bow getting off, to ensure that the others should be sufficient for collecting the current. For larger deviations of the conducting wire, the main spring arrangement of the whole arm begins to act.

THE BODY OF THE CAR.

On the basis of the requirements of the electrical equipment, the car was built by the firm, Van der Zypen & Charlier, of Cologne-Deutz, for accommodating 50 passengers. In consideration of the lengths required for the apparatus room and drivers' cab, the overall length of the body of the car is 21 meters (68.9 ft.), and the distance between buffer plates is 22.1 meters (72.5 ft.). The full width of the car is 2.6 meters (8.53 ft.). The body of the car (Fig. 2) remains in all its parts within the standard profile, but the middle part with the wide air-holes comes close up to this limit. The windows of the car are closed, ventilation taking place through the side windows of the very high skylight. On either side, at both ends of the car, are provided doors for the entrance and exit of the passengers.

The driver's cab (Figs. 13 and 14) is shut off from the passengers by a wide partition extending from the bottom to the top of the car, and serving as a back support for the occupant. On the sides thereof are grated doors, which during the stoppages at the station are arranged in such a manner that the driver's cab remains shut off from the passengers, granting them, however, access to the interior of the car. During the drive these doors are so adjusted that they block the exit and at the same time shut off the passengers, preventing them from disturbing the driver in the execution of his duty.

By the apparatus room the car is divided into two compartments. The passengers can, however, freely pass from one compartment to

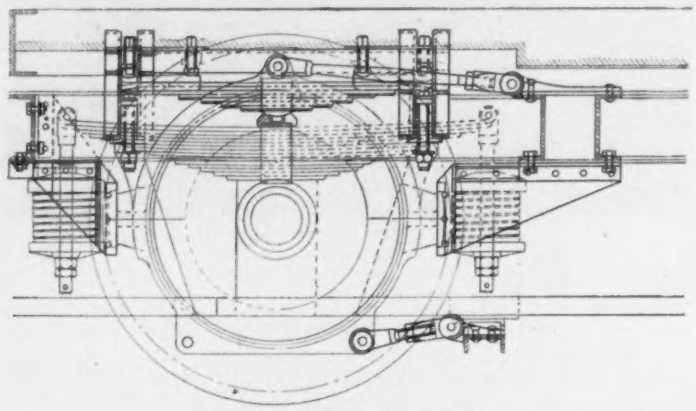

FIG. 7.—MOTOR MOUNTING.

the other, even when on the journey, in which case the apparatus room is protected in a similar manner to the driver's cab. Those parts which are liable to be touched by the passenger either do not carry current, or are suitably insulated.

As will be seen in the description of the cable arrangement the passenger compartments and also the driver's place are not under tension. The bows on the roof of the car are fitted with two insulators connected in series, each of which is tested to a potential of 20,000 volts. The high-tension current passes from here to the transformers through high-voltage cables, which, although they have been tested for 20,000 volts, are carried on high-tension insulators. Between the apparatus room and the passengers' compartments, and in

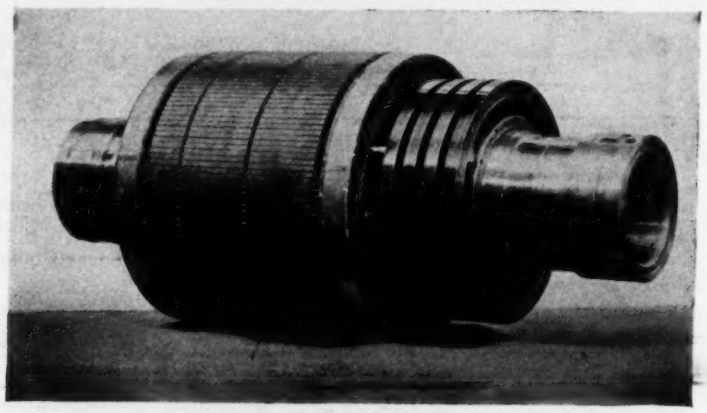

FIG. 8.—MOTOR ARMATURE.

the same manner between the passengers' compartments and the transformers suspended below the same, there are air shafts which form a double partitioned space. The storage batteries provided beside the transformers are likewise separated by double sheet metal walls.

The body of the car in its present construction is not of the shape generally expected for a vehicle running at a high speed. The car is slightly curved at the ends and not sloped off like the bow of a ship. The statements concerning the experiments which were made in this respect are contradictory, notwithstanding that they prove

that boat-shaped ends are of no advantage. One of the objects of the experiments is to clear up this point and to ascertain the difference in consumption of power at varying speed, also in the event of head and side winds. A suitable screen can be constructed at any time.

THE CAR TRUCKS.

The two trucks which carry the body of the car are 13.3 meters (43.6 ft.) apart. The diameter of the wheels was assumed to be 1.25 meters (4.1 ft.), thus enabling the trucks to swivel sufficiently below the car, while allowing the floor of the car being of the same level throughout its whole length.

Each of the trucks has three axles, the two outer ones carrying the motors, and the middle axle had to provide the necessary space for the pivot and the air cylinders of the Westinghouse brake. The dis-

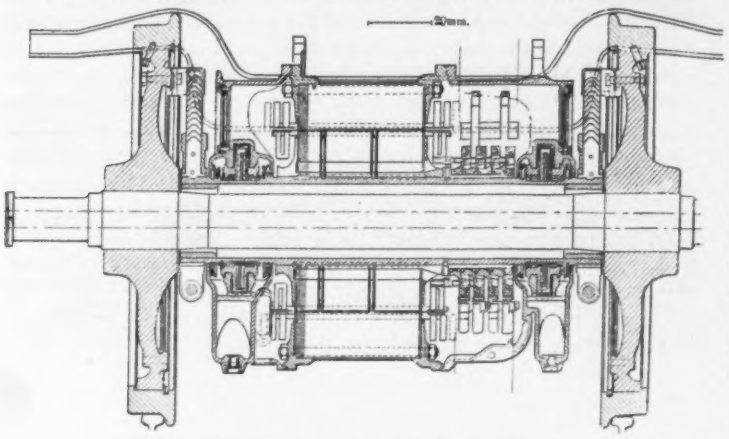

FIG. 9.—CROSS SECTION OF MOTOR MOUNTED.

tance between the wheels measures 2 (6.56 ft.) by 1.9 meters (6.23 ft.). Fig. 5 shows one of the trucks and the arrangements of the motors within the same. The load for each axle was less than the maximum allowed and amounted to a little over 14 tons.

An arrangement of springs bearing against the body of the car is not provided. The bogies themselves are supported against the axles by two sets of springs. Each axle box carries a strong plate spring, to the heads of which supporting springs are attached, which carry the frame.

On these axle boxes, i. e., on the shoe of the axle spring, plate springs are provided for carrying the motor. The connection between this spring and the motor frame is established by a curve block, against which the spring bears and on which it rolls off. By these shoes the spring action or its degree of elasticity can be varied. The first few millimeters it acts as a weak spring, then it begins to be more rigid, and at a deflection of about a quarter inch it becomes stiff. In the almost impossible event of these very strong springs breaking the motor is supported by the wheel axle with the interposition of a suitable metal packing close to the side of the wheel hub. The condition for the selection of a material for such packing were that it must be very soft for protecting the axle and hollow shaft, yet of sufficient resistance for bringing the car to a standstill before serious damage can be done.

The motors are firmly bolted to a riveted plate frame. The motor is protected against lateral movements by guide blocks, which bear against a corresponding guide on the frame of the truck. The casing of the motor is prevented from turning round by rods which only allow of its vertical movement (Figs. 6 and 7).

The transmission of the work from the motor to the wheels is effected by an elastic coupling entirely independent of the bearing construction (Fig. 11).

THE MOTORS.

Each of the four motors is adapted for a normal output of 250 horse-power and a maximum output of 750 horse-power. The speed of the motor is about 960 r. p. m., enabling the car to run at a speed of 225 km. (140 miles) per hour. The tension of 12,000 volts taken from the overhead wire is reduced in the transformers to 435 volts. This voltage was adopted so as to permit of constructing the motors with a bifurcated winding (Fig. 3). Although the motor, as above stated, is not subjected to a hammering action, it was nevertheless deemed advisable, for permanent safety in working, to have only one single bar in the separate slots of the primary, instead of a number of wires insulated from each other by a cotton covering. The insulation of the bars against the iron is effected by closed micanite tubing. In the same manner as the field winding, the armature or secondary winding is also constructed as bifurcated winding (Fig. 8). In consideration of the starting apparatus and cable arrangement the armature was wound with only two phases and not, as usual, with three phases.

The casing (Fig. 9) carries by means of two bearings the hollow shaft on which the armature body is built. One of these bearings (Fig. 10) carries in its top half the brush apparatus of the slip rings and the connections for the cables of the armature circuits which lead to the regulating apparatus. The cables of the primary circuit are passed through the other bearing. The bottom halves of the bearings can be easily removed, and allow of the removal of the brasses and also of free access to the brush apparatus.

Fig. 9 illustrates the journaling of the hollow shaft, and shows the manner of oiling the bearings. The oil level is located very high, so that when the motor is at full working condition the disk, which has to lift the oil still dips therein to a depth of 30 to 40 mm. (1 to 1½ inches). The material for the bearings is white metal of the alloy usually adopted for the Prussian State railways. Nickel-steel was adopted for the hollow shaft, both on account of its polishing qualities and the high degree of solidity or compactness of the material.

The radial distance between this hollow shaft and the axle is 30 mm. Copper rings are forced into the hollow shaft at both ends close to the hubs of the wheels. The hollow shaft is prevented from lateral displacement by one of the motor bearings; a guiding motion against only one of the bearings is adopted, so as not to produce, owing to heat and expansion of the material, a seizure between axle and bearing. The spring couplings are fixed on to the hollow shaft at both ends.

The object of this coupling (Figs. 11 and 3) is to transmit the torque of the motor—750 horse-power maximum at 960 revolutions—from the hollow shaft to the wheels, thereby allowing the latter a displacement against the coupling arms to the extent of 10 mm. (⅜ inch). To allow of this the arms must be elastic, and, moreover, the spring heads must slide against the guides mounted on the wheel. The construction of the whole required a division of the coupling into three parts, corresponding to the three double arms. The springs are built up securely in the annular pieces by wedges, in such a manner that the tension of the wedges is further increased by centrifugal force. Furthermore, the plates are laterally extended within the

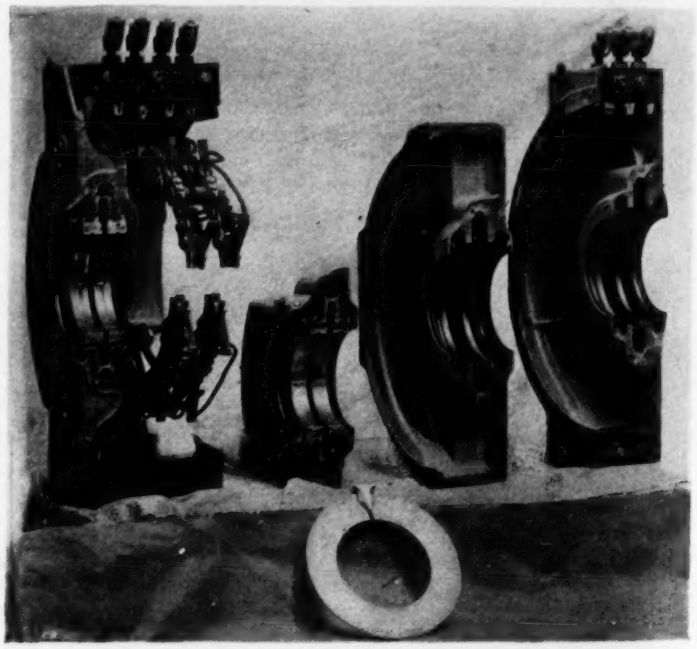

FIG. 10.—ONE OF THE BEARINGS.

hub and thus secured against flying out. The hub portions are of forged steel, the strain on the material therefrom being very favorable. The transmission of the power from the hollow shaft to the three-part hub of the coupling is effected by interposed springs.

TRANSFORMERS.

As to the transformers (Fig. 12), it may be added that the three cores are arranged side by side in accordance with the practice of the A. E. G. The axis of the cores is placed longitudinally in the car.

In conformity with the transforming ratio of 12,000 volts to 435 volts, the inner low voltage winding is arranged as a massive copper spiral, and the high voltage winding separated therefrom by a micanite cylinder. The iron cores are provided with a longitudinal slot, through which a strong current of air passes, in the same manner as through the space between the square cores and the round coil. The

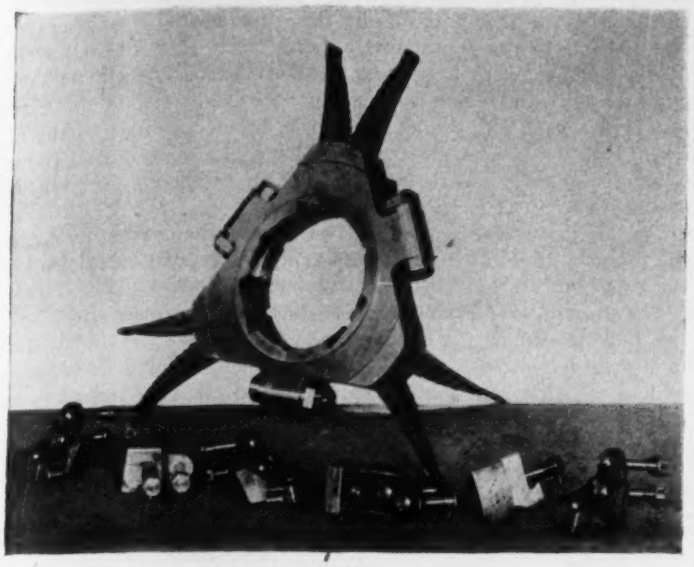

FIG. 11.—MOTOR COUPLING.

air for this purpose is, as above described, received through large air shafts on the roof and delivered through channels to the transformers. For the removal of rainwater, a protecting angle iron is provided on the roof, and before the air enters the shaft and the channels it passes several times through a wide meshed wire netting; the air is then conducted over the transformer and filtered again before entering the cores. Nothwithstanding these precautions, the air is only brought in direct contact with the interior of the cores of the transformer, and not with the current carrying parts. The cores are suspended in the middle of their length for the purpose of obviating any deformation due to the vibration of the car. The transformer is suspended to the body of the car by draw bolts, so that the lateral sheets are only used for lining purposes and have no strain to withstand. Any further arrangement of springs against the body of the car did not appear to be of any use, because the present arrangement of springs is similar to that adopted for the "International" sleeping cars and ought to be sufficiently springy to ensure a long life for the insulating materials.

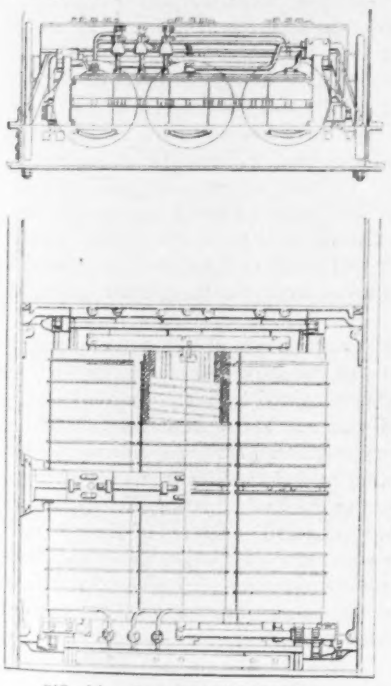

FIG. 12.—CAR TRANSFORMERS.

CABLES.

The current is taken from each of the three feeding wires by two bows in parallel. The upper part of the bow arms bears a number of aluminum rods connected to narrow plate springs. The weight of these single rods must be small enough to ensure a constant bearing against the wire.

The head of the arm which carries the above mentioned bow is stamped out of aluminum sheet and connected to the vertical foot by rods, such foot being mounted by ball bearings in the casings secured to the car. By means of springs, the tension of which is regulated by cams, the bow is held against the wire. The current is conducted from the head of the bracket in insulated leads to the foot of the current-taking arms and transmitted therefrom through a contact to the cables affixed to the roof of the car.

The bows are brought to touch the wire and separated from the interior of the car, in such a manner that before getting on the roof the bows can be made free from current.

All high-tension conductors are assumed as high tension cables, and have been subjected to an insulating test of 20,000 volts. Notwithstanding this fact, the conductors were treated as bare wires, and placed on high-tension insulators.

FIG. 13.—INTERIOR OF CAR.

Safety fuses are fixed close to the single bow. As soon as by some cause or other contact is made between any phase and the car put to earth, the car is made free from current by the melting of this fuse.

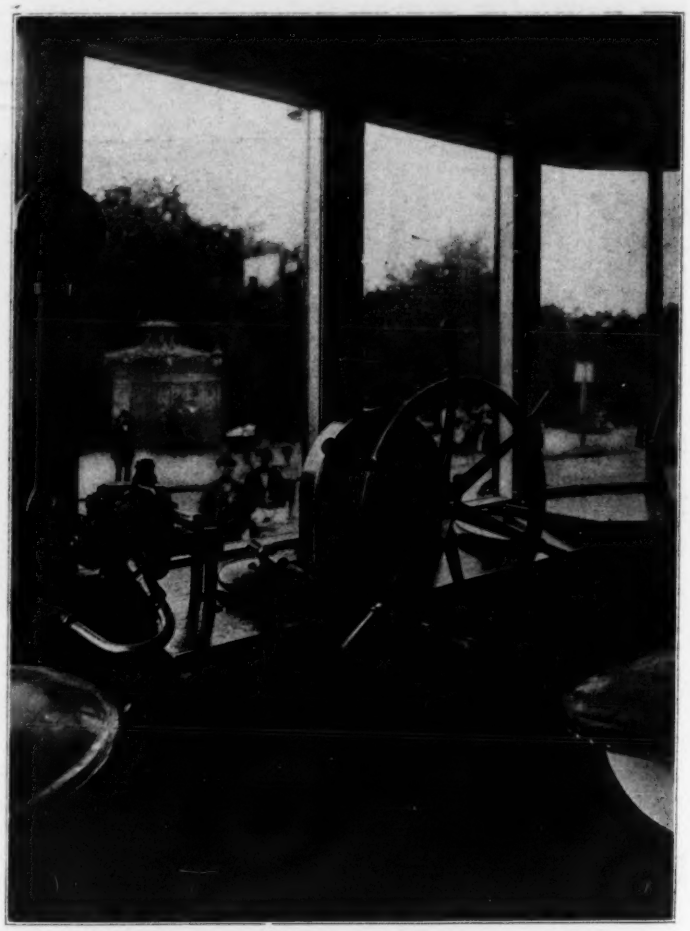

FIG. 14.—MOTORMAN'S WHEEL.

The wires of both collector systems lead from the safety fuses to the high-tension cut-out. This cut-out is not necessary for the control, and serves merely for cutting off the tension at the end of the drive.

The switch is operated from the apparatus room, or from either of the driver's cabs, thus serving as a safety switch in the event of the proper switch failing to act in case of an accident.

The two branches of current pass separately from this main switch to the two transformers of the bogey. Each of these circuits and transformers is protected by fuses. The low-tension conductors lead from the transformers through a switching device to the motors. On account of the play to be allowed between bogey and car, both with the lateral oscillation when running round curves and with the vertical deflection due to the action of the springs, the cables had to be hung up flexibly, i. e., the cables are suspended and supported by a strong girth or belt. The cables which lead from the motors back again to the starting device are secured by a similar girth.

The above mentioned switch effects the admission of the current to the motor casings from the transformers, and it furthermore allows of the adjustment for either direction of the driving, of the delivery of counter current. Besides, the storage battery is connected from here to the primary circuit of the motors when braking the car as an automobile, i. e., when braking independently of the overhead wire.

CONTROL OF THE CAR.

The car driver has to work only one single handwheel (Figs. 13 and 14) for carrying out all the operations. By means of an indicator, he can at any time ascertain the position of the apparatus, and by an amperemeter he can see the load on the motors. A further apparatus indicates continually the speed of the car.

By the handwheel (Fig. 14) the driver operates a shaft extending through the entire length of the car. By a pair of bevel wheels and cam wheels the switch is operated from this shaft. The movement of this cam gearing to the extent of one tooth effects the switching of the controlling cylinder to forward current, counter current or braking action. The intermediate path which the cam or gearing has to traverse is used for operating the valve of the liquid starting device. Reference is made above to this starting and regulating apparatus, but it may be repeated that the driver is in a position to regulate the speed of the car from standstill to the full speed of the motors within suitable limits, and that he can also effect a starting and braking movement as quickly and as softly as may be desired. The liquid of the starting device is fed continuously by means of a centrifugal pump through a cooling coil system through which a current of air continuously passes and is thereby constantly mixed and cooled.

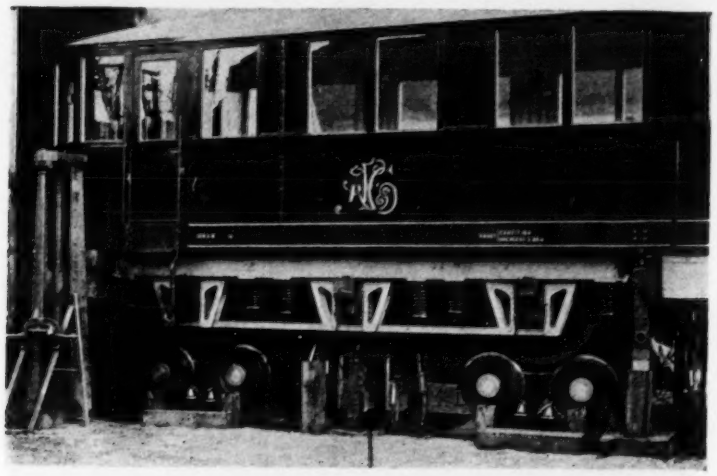

FIG. 15.—ARRANGEMENT FOR TRIAL OF CAR.

On the left of the driver is the handle for operating the compressed air brake, and on his right is another handwheel for the hand brake for shunting service. Other measuring apparatus is proposed for the trials, especially for indicating the acceleration of the speed, for measuring the air resistance in the event of a hand and cross wind, and also instruments for measuring and registering the consumption of current.

In view of the novelty of the entire construction and almost every single part of the electrical equipment, and of the great responsibility which the constructor had undertaken, it was deemed advisable to make trials with the car stationary. Four trailing axles, each provided with two rollers, were mounted on heavy cast iron erecting plates, for the two-motor axles of a bogey (Fig. 15). In view of the maximum circumferential velocity of 56 meters (183 ft.) per second, the rollers were made of steel casing and the bearing rims received the profile of the rail head. Wide, plain rims were provided laterally for putting on a brake strap, which, of course, had to be specially designed for the case in question, as also the rollers. The rollers are carried in plummer blocks, having white metal brasses. The speed of the rollers is 1800 r. p. m. By this experimental arrangement, it was possible to run the motors of each truck up to the full speed. The weights required for testing the brake action of the motors and batteries were, unfortunately, wanting; the small weights of the motors and wheel sets cannot furnish sufficient proof as to the efficiency of the brakes. On the other hand, the experimental results of the brake action having proved so highly satisfactory, the braking system cannot be considered objectionable.

The above statements give an idea of how the constructor solved the problem, to which we may add that the practical experiments in the trial platform gave very favorable results.

The great interest which the engineers of the whole world take in the development of the express railway has led to the publication of the above particulars. The question whether the speed aimed at will be fully attained depends partly on the car itself and partly on the nature of the track. For gaining further experience on this point and also with regard to the consumption of power for the varying working conditions, a good deal of time is still required, and this brings us to the second problem to be solved.

There is already sufficient experience at hand for many requirements and conditions of the electrical long-distance system, and many tests, the results of which will apply to both low and high speeds, can now be carried out without any difficulty.

Motor Generators vs. Rotary Converters.

A GOOD opportunity recently offered itself at the Oerlikon Works to test exhaustively two different types of motor-generators of considerable capacity, as to their efficiency, power factor, rise of temperature, regulation and individual losses. The machines tested are part of a large order for two central stations.

The machines are of three-phase direct-current motor-generator type, in one case consisting of a synchronous motor for 3500 volts and 50 cycles, coupled to an eight-pole direct-current dynamo for a normal output of 260 volts and 1350 amperes at 375 r. p. m. In the other case, the set is made up by a three-phase induction motor for 6000 volts and 50 cycles, coupled to a four-pole direct-current dynamo for a normal output of 450 volts and 510 amperes at 370 r. p. m. As several machines of each type were available, the set under test could be run under permanent full load without the expenditure of much energy. This was done by running one set with its three-phase current side as a motor and with its direct-current side as a generator, whilst the other set worked on the same circuits with its direct-current side as a motor and with its three-phase current side as a generator. The measurements were for the greater part made by the same instruments.

The results obtained are given herewith in the form of curves, but it should be said that some of the curves—notable the V-curves of the synchronous motor—were obtained by a calculation based on a limited number of observed values. The differences between the values representing the efficiency calculated from the individual losses and the values directly measured at different loads, were so trifling, that the mean values were taken as the basis for the efficiency curves.

In Fig. 1 are represented the characteristic curves of the synchronous motor at no load and on short circuit, plotted as a function of the exciting current. This same engraving also gives the individual losses as a function of the energy absorbed, and finally the V-curves at full load, half load and no load. The dotted curves represent the power factor (cos ϕ) at full load and half load as a function of the exciting current.

Fig. 2 gives the curves of the eight-pole direct-current generator coupled to the above synchronous motor, the characteristic curve at no load being a function of the excitation, and the individual losses and the total efficiency a function of the output in kilowatts.

Fig. 3 shows the total efficiency of this set and the power factor at two different values of exciting current kept constant, and as a function of the output of the direct-current generator.

Fig. 4 contains the usual curves for the efficiency, cos ϕ, primary

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and secondary current and the individual losses of the 350-hp, three-phase induction motor.

Fig. 5 gives the curves for the four-pole direct-current generator for 450 volts, coupled to the induction motor referred to in Fig. 4.

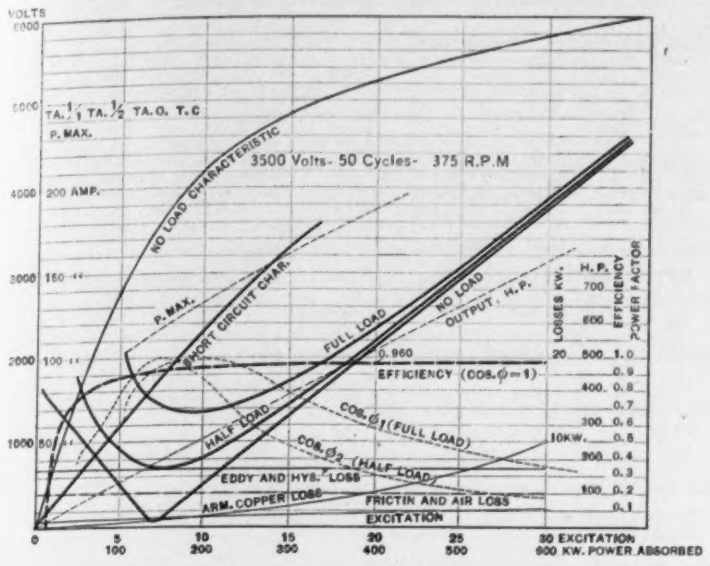


FIG. 1.—CURVES OF 525-HP, THREE-PHASE SYNCHRONOUS MOTOR.

Fig. 6 represents the total efficiency and the power factor of this latter set.

It may be added that after a 10 hours' run under full load the temperature rise did not exceed 30 degs. C. in any part of the windings and in the iron core of the three-phase current motors, nor of the direct-current generators. The commutators showed a temperature rise of only 35 degs. C. By specially dimensioning and forming the pole cores, all sparking of the carbon brushes on the commutators was avoided without adjustment of the brushes when the load was changed from full load to no load. It is quite evident from the values of the individual losses that if the carbon brushes were replaced by copper brushes, the efficiency of the direct-current generators, and thereby of the whole set, would be increased fully ½ per cent.

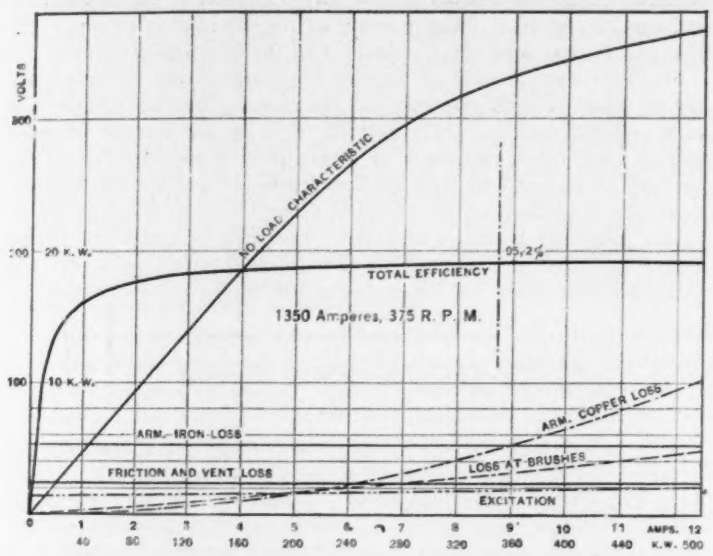


FIG. 2.—CURVES OF 350-KW DIRECT-CURRENT GENERATOR.

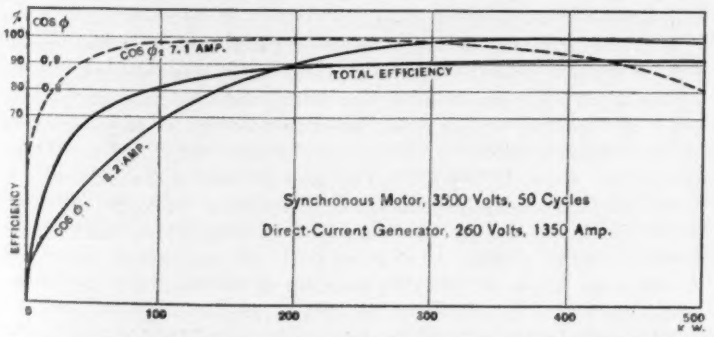


FIG. 3.—POWER FACTORS AND EFFICIENCY OF 350-KW MOTOR-GENERATOR.

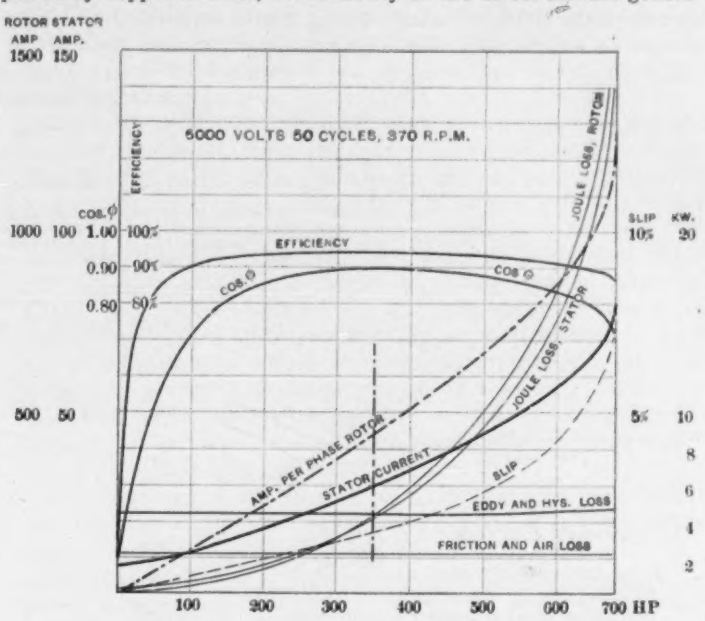


FIG. 4.—CURVES OF 350-HP, THREE-PHASE INDUCTION MOTOR.

For comparison with the data of some machines by another manufacturer, consisting of a static transformer and a rotary converter with a common armature for three-phase and direct current, values taken from the curves are given in the accompanying table. These sets consist each of three single-phase transformers and a rotary converter for 550-volt direct current, the frequency being 25 cycles and the rated capacity 250 kilowatts and 500 kilowatts, respectively.

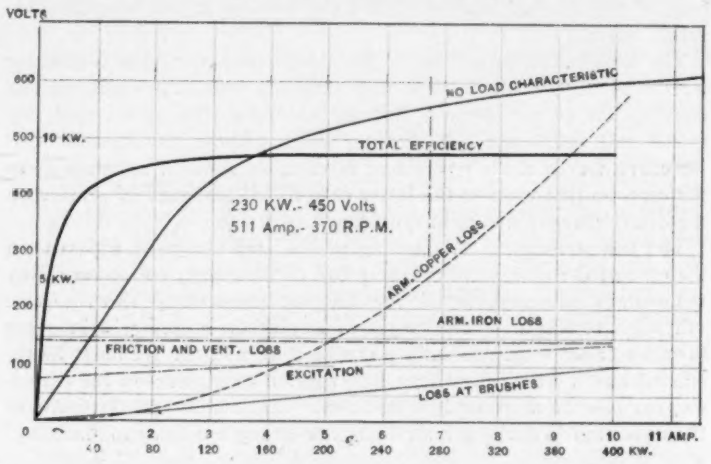


FIG. 5.—CURVES OF 230-KW DIRECT-CURRENT GENERATOR.

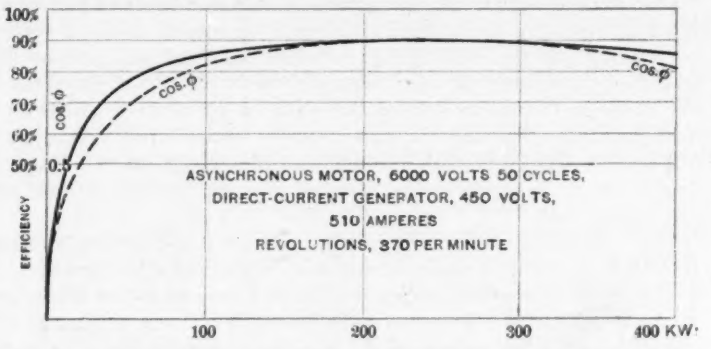


FIG. 6.—POWER FACTOR AND TOTAL EFFICIENCY OF 230-KW MOTOR-GENERATOR.

To make the comparison more conclusive the starting, the capacity and the "falling out of step" of the machines of the different types may also be considered.

The motor-generator set with induction motor starts with a current which at the most exceeds the no-load current by 10 per cent, or, in other words, with about one-fourth of the normal current. On the hub of the rotor is fixed a rotating starting resistance which, by means of a special connection, cuts out one phase after the other of the rotor circuit. This starting switch is so dimensioned that it just suffices to start the set, and is thrown in and short circuited by a lever having four different positions, which manipulation takes about 40 seconds.

The motor is capable of standing an overload of at least 100 per cent of the normal load, provided the tension at the terminals remains normal.

The well-known properties of the induction motor make it possible for the set to operate if the circuit suffers a momentary and sudden interruption, as, for instance, through lightning striking the line. The motor will again attain its normal speed without an excessive call for current even if the number of revolutions falls off as much as 10 per cent, so that even in the latter case the disturbance of service on the direct-current side is insignificant.

The consequence of this falling out of step are quite different in the case of the synchronous motor and of the rotary converter. Any momentary interruption of the line or momentary short circuit (through atmospheric discharges or any other cause) will in every instance cause a serious falling out of step, and the set must be restarted anew, which means an interruption of service on the direct-current side of more or less duration. Another feature in favor of the induction motor is the total absence of any tendency to "hunting" and "pumping."

In the present case the motor-generator set with the synchronous motor is set to work by starting the direct-current generator as a motor from the direct-current bus-bars. The starting current amounts to about 10 per cent of the current at normal load.

The overload which the synchronous motor is capable of standing depends largely upon the value of the exciting current used for regular running. If the exciting current is so regulated that under full load the power factor is unity, then the Oerlikon type of synchronous motor will stand an overload of about 90 per cent. If, however, the excitation is increased in such a manner that the power factor at full load is about 0.97 with a component of the current in advance, then the motor is capable of an overload of more than 100 per cent of the normal load.

The transformer sets with rotary converter are generally also started from the direct-current side with equally small currents.

The above comparison indicates that with respect to the efficiency attainable, the three different systems are about on a par, at least in all cases where the line voltage of the alternating current is not so high that the induction or even the synchronous-motor requires a previous step-down transformation. As far as the power factor is concerned, the induction-motor system appears to be, depending upon the regulation of the excitation, from 5 to 10 per cent behind the system employing a synchronous motor.

If, however, the decision depends upon the merits of the simplicity of the starting manipulation, upon the extremely great safety of service in the case of interruption to the line and the absence of tendency to hunting of the generators, then the induction motor system appears to be by far the most advantageous of all.

COMPARISON OF MOTOR-GENERATORS AND ROTARY CONVERTERS.

	I. Oerlikon high-tension synchronous motor, coupled to a direct current generator of 350 KW., 375 r. p. m. and 50 cycles			II. Oerlikon high-tension induction motor, coupled to a direct-current generator of 230 KW., 370 r. p. m. and 50 cycles.			III. High-tension static transformer, with artificial ventilation, and rotary converter of 250 KW., 750 r. p. m. and 25 cycles.			III. High-tension static transformer, with artificial ventilation, and rotary converter of 500 KW., 500 r. p. m. and 25 cycles.		
WEIGHT (Tons)	Motor	Gen.	Total	Motor	Gen.	Total	Trans.	Conv.	Total	Trans.	Conv.	Total
	12	11	23	8	9.5	17.5	4.65	8	12.65	6.9	14.5	21 4
EFFICIENCY (Per Cent.)	Load	Motor	Gen.	Total	Motor	Gen.	Total	Trans.	Conv.	Total	Trans.	Conv.	Total
	Full	96	95	91	94.5	95	90	96 6	92.7	89.5	97	93.2	92.5
	½	93	92.5	87	93	92 6	86	95.2	89 2	85	95.8	89.5	85 5
	¼	88	90	80	89	88	78	....	....	....	92.2	....	....
POWER FACTOR (Total)	Full load. 1.0*				0.91							
	Half load..... 0.9				0.84							
	Quarter load 0.7				0.68							
TEMPERATURE RISE (Centigrade)	Iron core..... 30				30			45			45	
	Windings..... 30				30			45			45	
	Commutator.. 35				30			55			55	

* This is the power factor if the excitation is constant; if this is regulated, then the power factor is unity under all loads.

The motor-generator as compared with the rotary converter has the advantage that the tension of the direct current is independent of and can be regulated independently of the alternating-current voltage, and is free from the fluctuations of the alternating current.

Finally, from the point of view of the designer, the variable number of poles in both machines of the motor-generator system is a very essential feature, which permits of fixing the number of poles just as small as is necessary to secure perfect commutation of the current, no matter how high the line frequency and the speed of the three-phase current motor. On the other hand, in the case of the rotary converter system a periodicity exceding 30 cycles per second necessitates such a large number of poles as to give rise to very unfavorable conditions for the commutation of the direct-current.

Telephony and Mail Service.

It is stated that a feature of the postal service not enjoyed by any other city in Michigan has been inaugurated recently in the Saginaw Post Office. It consists simply of a system of collecting and delivering mail in response to telephone calls for such service. Its principal value will be in the delivery of letters in the same city. Mail intended for local delivery may be called for by the messenger and accepted for delivery, provided the postage is prepaid and a special delivery stamp is affixed. Upon receipt of the matter by the messenger he will at once take it to the post office, that it may be properly recorded, postmarked and the stamps thereon cancelled, as if mailed at that station, when it will be immediately taken out for delivery to the addressee in the usual manner.

Mail intended for dispatch to other cities may be called for in similar fashion, but two special delivery stamps are needed, one on an outer envelope addressed to the special delivery clerk of the post office and another on the inner envelope bearing the proper address of the person to whom the letter is to be delivered. Mail matter intended for dispatch, but not for special delivery at the office of address, may be similarly collected by the special delivery messenger when the letter is inclosed in another to the delivery clerk and a stamp properly affixed. In this case only one special delivery stamp is necessary, but in all cases the payment of the usual two cents postage is necessary in adition to the other stamps.

The experiment is being watched with considerable interest by post office officials. It is said that if the service proves successful in the cities in which it is being tried it may be adopted in the smaller cities of the country where there is not too much ground to be covered.

Elements of Illumination—XXXI.

By Dr. Louis Bell.

STANDARDS OF LIGHT AND PHOTOMETRY.

OF all important physical constants none are in so unsatisfactory a state as those pertaining to illumination. In spite of the efforts of several scientific congresses, there is no international convention regarding the unit of luminous intensity, nor is there any one practical unit in general use.

A standard to be worthy the name should be accurately reproducible without extreme difficulty, and ought, as well, to bear a fairly simple relation to other units which are related to it. Now, a standard of light stands quite by itself in kind, and should consist of some determinate light-giving body so constituted that it can be reproduced and used in any part of the world without material error.

Unhappily, such a light-giving body is not easily, if at all, obtainable, hence the present confusion.

The only attempt yet made to produce a really logical and scientific unit was that brought to the world's attention by M. Violle at the international electrical congress held in Paris in 1884. Violle proposed as the unit of luminous intensity the light emitted, normal to its surface, by one square centimeter of platinum at its melting point.

This unit was one based on definite things; was of very convenient magnitude, about 20 candle-power; and of good color, nearly white. But it is a very inconvenient unit to work with, and to reproduce accurately, on account of the enormous temperature necessary to melt platinum, the uncertainty introduced as to its exact melting point by the presence of trifling impurities, and for other minor reasons. So the upshot of the matter has been that this unit has been laid upon the shelf, and while much good came from the agitation of the subject the world still depends on the curious assortment of units sanctioned by more or less extensive usage.

The practical and legally adopted unit of light in English-speaking countries is the so-called *standard candle.* This illuminant has its composition, dimensions, weight and rate of burning specified by law, and can be cheaply and easily obtained. It is a spermaceti candle, weighing 1200 grains avoirdupois (6 to the pound), and burning at the rate of 120 grains per hour. The standard diameter is 0.8 inch at the top and 0.9 inch at the base, and the normal height of the flame is about 1⅞ inches over all.

The rate of burning may vary in practice from about 110 grains to 130 grains per hour, and in photometric work the luminous intensity is assumed to vary directly with the rate of burning. Selected candles burned under uniform conditions run somewhat closer to the standard rate of burning than the above figures, and burn with a uniformity that, considering their structure, is remarkable, but the presence of the wick, accidental variations in manufacture and numerous minor causes, make the candle at best rather unreliable. With great care in using it may be coddled into a degree of precision of approximately two or three per cent, but variations of twice that amount are not uncommon.

In France, and to a considerable extent in Italy, the Carcel lamp is used. This is a standard which was adopted after the investigations of Dumas and Regnault some 40 years since. It is an oil lamp of special construction, made according to a very minute specification as to dimensions, including the structure and weight of the wick, and burns refined colza oil, largely used as an illuminant in France. Its normal consumption of this oil is 42 grams per hour, with a permissable variation of 4 grams per hour in either direction. It gives a rather yellowish light of nearly 10 candle-power, and has probably about the same possible degree of precision as the English candle, though it should average a little better.

In Germany a standard paraffine candle made in pursuance of a most elaborate specification is used to some extent. It carries a longer flame than the English candle, 2 inches being the standard height, and is about 10 per cent more powerful, with, in other respects, much the same general properties.

The standard most used in Germany, however, and often employed in other countries for purposes of reference, is the so-called Hefner unit, being the light given by the amylacetate lamp introduced by Von Hefner-Alteneck. This standard lamp is made from a uniform specification as to dimensions, and has the great advantage of burning a perfectly definite chemical compound easily obtained in a state of great purity. It has been very exhaustively investigated at the Reichanstalt from which certified tested standard lamps can readily be obtained, and its performance under varying conditions of flame height, temperature, barometric pressure and so forth, has been carefully studied. Its normal flame is 40 mm. high and its intensity is about 10 per cent less than that of the English candle.

Being the legal standard in Germany, and widely used elsewhere on account of its steadiness and the accessibility of certified examples, the Hefner-Alteneck lamp comes nearer to being as real international standard than any other. When used in strict accordance with the minute instructions accompanying each lamp it is subject to errors not more than half as great as those met with in standard candles, and while not perfectly steady is far steadier than a candle or a Carcel lamp. Its weakest point is its color, which is distinctly reddish orange. This constitutes a rather serious objection to its use as a working standard in measurements made, for instance, on mantle burners or incandescent lamps. Even as a primary standard, its color and rather small intensity form an obstacle to its convenient use, but all in all it has been rather generally recognized as the best primary standard yet devised.

Reproducibility is the principal requirement in a primary standard, and this the Hefner-Alteneck lamp possesses to a very unusual degree.

In working standards the most necessary qualities are great temporary steadiness and convenience as to color and intensity. These requirements are far more easily met than that of exact reproducibility, and in practical photometry, reliable secondary standards are obtained with comparative ease.

One of the simplest and most useful is obtained from an Argand gas burner, such as has already been described as used for testing purposes. Burned at a carefully regulated pressure with a delicate meter to adjust the consumption by, and a blackened screen to cut off all the light save that through a narrow aperture of definite dimensions, a gas jet gives a wonderfully steady light, extremely well suited to photometric work. This arrangement is substantially that of the Methven screen which is widely used in photometry. If it were practicable to prepare on short notice a gas of definite composition this apparatus might make a good primary standard, but attempts along this line have not been very successful. Acetylene has been suggested for the purpose, but experiment has shown that it is peculiarly subject to variations in luminous intensity and is worthless as a standard illuminant.

Aside from the Methven screen, the most generally used secondary standard is the incandescent lamp. If the filament is not worked at too high a temperature, i. e., at too great efficiency, and is aged by several hundred hours of preliminary burning, it constitutes an admirably reliable standard. Burned at a fixed and uniform voltage its intensity can be accurately determined from comparison with a primary standard, and remains very nearly uniform, having a slight and definitely ascertainable decrement with time. In practical photometry such a lamp is merely balanced against an ordinary aged lamp used in the photometer for testing purposes, remaining itself a reference standard.

Several attempts have been made at an incandescent lamp as a primary standard, the filament being of definite material and dimensions, enclosed in a globe of specified character, and worked with a definite amount of current. The result has not so far been encouraging, and in the absence of anything better the Hefner-Alteneck lamp is the main reliance as a reproducible standard. At the time the Violle standard was proposed one-twentieth part of it was tentatively adopted and styled the bougie décimale, but this somewhat hypothetical unit has never come into any repute, although its relation to the more common standards has been determined with a fair degree of precision.

The following table gives the relation between the several primary standards here referred to with perhaps as much precision as the nature of the case permits, perhaps rather more since one must admit that in photometry the third significant figure is of somewhat dubious value.

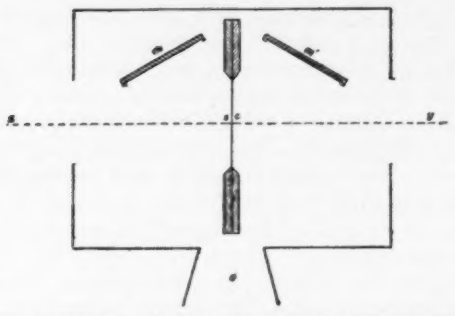
	Bougie décimale.	Carcel.	Hefner unit.	German candle.	English candle.
Bougie décimale.....	1.	0.104	1.13	0.955	0.97
Carcel	9.6	1.	10.9	9.20	9.6
Hefner unit.....	0.885	0.92	1.	0.815	0.91
German candle.....	1.05	0.109	1.23	1.	1.092
English candle.....		0.104	1.099	0.915	1.

There are here some evident discrepancies which serve to mark the unsatisfactory state of the art, and to measure the uncertainties which exist.

Given a standard, such as it may be, the process of comparing a given radiant with it is extremely simple in principle and somewhat troublesome and unsatisfactory in practice. The difficulties come in part from the inherent difficulties of the process in general and in part from the complications introduced by variations in the color of the light.

The Bunsen screen, which in ordinary practice is the backbone of photometry, has already been in some measure described together with one of its simplest applications. The general principle is that a translucent spot in a nearly opaque screen of light texture disappears when equally illuminated from each side. But for this to happen requires that the screen be entirely symmetrical. Light falling upon it must be transmitted through, and reflected from the surface of the grease-spot in precisely equal measure irrespective of the side of the spot on which the light falls. If not when viewed obliquely from one side the spot will seem to disappear at a particular point, but when viewed from the other side this point will be shifted. Moreover, unless the screen be viewed from the same angle on each side, it will not balance at the same point even if the spot be absolutely symmetrical as regards its two faces. If this condition is fulfilled one side of the spot will generally accumulate dust a trifle more freely than the other, and throw things out of balance again.

To eliminate as far as possible such difficulties it is usual to arrange the Bunsen screen so that both sides can be observed simultaneously, and from the same angle. To this end the apparatus is arranged as in the diagram. The screen marked *sc* in the cut is



ARRANGEMENT OF BUNSEN SCREEN APPARATUS.

placed in a blackened box, having openings in the ends along the line *xy* between the lights to be compared, and a lateral opening *O*, in which the edge of the screen is central. Two ordinary pieces of mirror, cut side by side from the same glass, are set vertically in the screen box in the positions *mm'*, as shown. To the observer looking fairly into *O* the reflected images of the two sides of the screen then appear side by side, and the slightest change in the appearance of either may be at once noted. Sometimes the mirrors are fitted to slide out so that they may be interchanged and another reading taken, and sometimes the sight box itself is arranged to revolve 180 degs. about a horizontal axis in the plane of the screen. The interior of the box must be blackened with extreme care to avoid diffused light.

In observing with this sight box one soon falls into a very uniform habit of setting the screen by reference to both its sides, and can take wonderfully concordant readings. But vision differs in different persons, and the "personal equation" in photometric work is of considerable importance.

Legality of Telephone Oath.

An affidavit by telephone, taken by a justice or notary, is legal, according to Judge Burke, of the Circuit Court at Baltimore, who, on Sept. 11, gave his decision to that effect in the case of the petition of the Manor Lumber Company, of Baltimore County, asking for the revision of an order appointing Osborne I. Yellott receiver for the concern. When Mr. Yellott was ready to file the necessary papers asking for a receiver, he had Mr. Cross come to the telephone at Cincinnati, and Justice Thomas Butler, who knows Mr. Cross very well, took his affidavit to the bill. The contention was made by the attorney for the company that affidavits taken in the manner described are not legal and bona fide.

The Induction Motor for Electric Railways—II.

(*Concluded.*)

In last issue was published an abstract of a paper read by Mr. A. H. Armstrong before the Buffalo convention of the American Institute of Electrical Engineers, entitled "Notes on Modern Electric Railway Apparatus." As already stated, Mr. Ernst J. Berg read at the same meeting a paper entitled "Electric Railway Apparatus," of which an abstract follows:

Mr. Berg's paper starts out with a discussion of the latest practice in the design and operation of apparatus employed in electric railway work; direct-current generators, alternating-current generators, inverted converters, rotary converters, synchronous and induction motor-driven direct-current generators, and direct-current railway motors being taken up in turn. The greater part of the paper, however, is devoted to a consideration of the induction motor in railway work, and this portion is reprinted below almost in full.

Alternating-current railway motors are of the polyphase induction type, and therefore their characteristics are essentially those of direct current shunt motors, that is, they run efficiently only at one speed, whereas the direct-current series motor will operate at high efficiency over a considerable range of speed. It is therefore obvious then in railway service where the speed for many reasons has to vary during the run and where cars are stopped and started at rather short intervals, the actual power taken by the induction motor will be greater than that taken by the direct-current motor. Since, furthermore, any induction motor must take a certain amount of wattless current, the apparent power input of the motor must be greater than with direct current. With the same mechanical clearance in the two types of motors, the amount of wattless current taken by the induction motor would be quite prohibitive, therefore these must be made with decidedly smaller air-gap than direct-current motors, which necessitates more careful adjustment, and involves more repair work. The wattless current is also dependent upon the voltage at which the motors are operated, and increases as the voltage increases. With the known methods of insulation and with the limited space available for railway motors, it seems that it is almost out of the question to consider a design at higher potential than 3000 volts. Even with the smallest safe air-gap this will give a power factor of at the most 85 per cent or 88 per cent at full load under the best conditions, which, with an efficiency of, say, 86 per cent including gear loss, gives an apparent efficiency of at the most 77 per cent; in other words, the kilovolt-ampere input of the motor would be about 30 per cent greater than that corresponding to the work done. Whereas, with the direct-current motor the power input would probably not be more than 12 per cent, or 15 per cent greater than that corresponding to the work done.

Therefore, and in view of the laws governing the design of such induction motors, it is to be expected that the copper losses in an alternating-current motor will be decidedly gerater than in a direct current motor. The core loss in the field of the induction motor is also greater than the core loss in the armature of the direct-current motor at maximum speed, so that this gives another source of increased heating of the motor. This increased heating is decidely objectionable, as it involves the use of a much larger machine than the direct-current motor, which increases the cost and weight of the equipment. To illustrate this somewhat more concisely, consider the losses occurring in a couple of motors of direct and alternating-current type while accelerating from standstill up to full speed. The core loss and eddy losses in the direct current motor are zero at standstill, and increase to a certain maximum at full speed. In the alternating-current motor at standstill even under favorable conditions, the core loss in the field is the same as the maximum core loss in the armature of the direct-current machine, and the core loss in the armature at standstill about the same as in the field. At full speed the core loss in the field still remains the same, but the core loss in the armature is zero, and therefore, roughly speaking, the core loss of the direct-current motor is in the neighborhood of half of the core loss at maximum speed, while accelerating, and is one and a half times as much in the alternating-current motor.

In other words, during acceleration the alternating-current motors have three times as much core loss as the direct current. Adding to this loss the greater copper loss due to the larger power input of the motor, we find from actual calculations that the alternating-current motors of good design will have in the neighborhood of four times as much loss as the direct-current motors when operating over

relatively short lines, as would be the case in rapid transit systems. To dissipate four times as much energy means that the volume of the motor has to be very much greater, and its heating facilities decidedly better. This does not mean that the actual heating will be as much more, since at least in long-distance runs, the time of accelerating is short compared with the total time of the run, nevertheless, the loss will be decidedly more and consequently it would seem as if the actual cost of the induction motor equipment per car would be from 50 per cent to double that of direct equipments, depending upon the service. Since the cost of the motor equipment is a very large factor in the installation of a plant, and since the direct-current equipment is so standardized and brought down to the least possible cost here in the United States, this is probably one of the main reasons why upon careful examination it has been found not only a saving of power, but great economy in the first cost to install direct-current rotary converters instead of alternating-current systems. In places, however, where the direct-current railway system is not so fully developed, the difference in cost between the two systems might not be so much, and that accounts for some European concerns installing alternating-current motors. To illustrate more fully the characteristics of the two types of motors, the following example is considered:

A double-track road with 27 stations is supplied power from a station located a distance from the tracks. Eight trains are running in each direction, which cover the entire distance in 52 minutes.

Weight of loaded train, including locomotive equals 180 tons (2000 lbs.).

Weight on driving wheels equals 50 tons.

Thus maximum draw-bar pull at 25 per cent of weight equals 25,000 lbs.

Which corresponds to a maximum acceleration of 2 ft. per second, per second.

Distance of run is 2560 ft.

Schedule speed, 15 miles per hour.

Maximum speed, 27 miles per hour.

Total distance is covered in 95.5 seconds, 20 seconds allowed for stops at each station.

No appreciable grades exist and effect of curves is negligible.

The three systems considered are:

A. The standard direct-current railway system with series parallel control of the motors.

B. Three-phase induction motor system with rheostatic control.

C. Three-phase induction motor system with concatenated control in accelerating as well as braking.

Obviously, when running at uniform and maximum speed one system offers no advantage over any other in energy consumption, assuming same efficiency of the motors (which is very nearly the case) while the volt-amperes taken by the motors are about 20 per cent greater with the alternating-current system (running at relatively light load).

While braking, the use of either of the first-mentioned systems is immaterial, since no return of power can take place, but the third, that with concatenated control, offers some advantage in returning power which, however, is practically offset by the large current taken, and the complication of control and design of motor.

While accelerating, however, marked differences exist in the three systems, therefore the choice of one or the other is largely dependent upon the relative time of accelerating, running at uniform speed, and braking. Since, furthermore, the power required with any particular system depends upon the method of accomplishing the run, a number of schedules have been worked out.

The important results of the various runs are shown in the table given below, which undoubtedly is more comprehensive than the diagrams for a superficial investigation.

Columns A, B and C are most important, and show the conditions of the best runs. Upon the constants given there and the corresponding curves the rest of the investigation is based.

Columns D and E show two direct-current runs at different gear ratios.

Columns F and G show two runs with rheostatic control only.

Columns H, I and J show three runs with concatenated control in accelerating only.

Columns K and L show two runs with concatenated control in breaking as well as in accelerating.

In going over the matter in more detail are considered the direct-current run, as shown in Column A, and the alternating current runs with rheostatic and concatenated control as shown in Columns B and C.

To sum up the results, it is found from the various methods of running trains, first, that under apparently the most favorable as well as average conditions, the most economical alternating-current system will take 26 per cent more power and 2.2 times as many volt-amperes as the direct-current system. Second, that the concatenated control takes 26 per cent less power, but only 10 per cent more apparent power than the alternating-current system with rheostatic control. It must, however, be borne in mind that these values refer to power input at the motors, not the relations at the sub-stations and power house, as will be seen later.

Power is supplied to four sub-stations located, respectively, 16,600 ft., 17,400 ft., 22,800 ft., and 35,000 ft. from the generating station. The transmission potential is 11,500 volts.

Since the supply of power is located at some distance from the receiving circuit, high-potential three-phase generators are proposed in all three cases.

	D. C. Series Paral. 33 Seconds Coast. A	A. C. Rheostat 14 Seconds Coast. B	A. C. Concat. 14 Seconds Coast. C	D. C. Motors 42.5 Seconds Coast. D	D. C. Motors 14.5 Seconds Coast. E	A. C. Rheostat 40 Seconds Coast. F	A. C. Rheostat No Coast. G	A. C.—Concat. only when Accel. 40 Seconds Coast. H	A. C.—Concat. only when Accel. 14 Seconds Coast. I	A. C.—Concat. only when Accel. no Coast. J	A. C. Contat. Brake and Accel. 40 Seconds Coast. K	A. C. Concat. Brake and Accel. No Coast. L
K. W Seconds Accelerating	21800	31700	25100	22700	23000	39100	31100	30900	25100	22700	30900	22700
K. W. Seconds Uniform Speed	....	5400	5400	....	....	....	7800	....	5400	7800	....	7800
K. W. Seconds Braking	....	....	—3230	....	....	....	....	....	....	....	—2800	—5400
Total K. W. Seconds	21800	37100	27270	22700	23000	39100	38900	30900	30500	30500	28100	25100
Average K. W. per Run	190	322	237	197	200	340	338	268	265	265	244	218
K. V. A. Seconds Accelerating	21800	37000	33600	22700	23000	44900	35800	40000	33600	32100	40000	32100
K. V. A. Seconds Uniform Speed	....	6600	6600	....	....	....	9500	....	6600	9500	....	9500
K. V. A. Seconds Braking	....	....	7730	....	....	....	....	....	....	....	5400	10600
Total K. V. A. Seconds	21800	43000	47900	22700	23000	44900	45300	40000	40200	41600	45400	52200
Average K. V. A. per Run	190	379	416	197	200	390	394	348	350	362	394	454
Maximum K. W. per Run	780	977	977	912	725	1080	965	1080	977	965	1080	965
Maximum K. V. A. per Run	780	1140	1140	912	725	1240	1110	1240	1140	1110	1240	1110
Watt Hours per Ton-mile	70	120	88	73	74	126	125	99	98	98	91	81
V. A. Hours per Ton-mile	70	138	154	73	74	145	146	129	129.5	134	146	168
Ratio $\frac{\text{Average a-c K. W.}}{\text{Average d-c K. W.}}$		1.72	1.26			1.80	1.79	1.41	1.40	1.40	1.30	1.16
Ratio $\frac{\text{Average a-c K. V. A.}}{\text{Average d-c K. V. A.}}$		1.97	2.20			2.07	2.09	1.85	1.85	1.92	2.09	2.40
Average P. F.	1	87	57	1	1	87	86	77	75.5	73	62	48

A. Direct-current motors with series parallel control.

Installation.—The road-bed has double tracks of 85-lb. rails and the combined cross-sections of feeders and trolleys for two tracks is 1 square inch of copper. In the calculations, all tracks and feeders are assumed interconnected, and the feeder copper strung all around the track.

The resistance of steel rails is assumed as 12 times that of the corresponding copper, and that of bonds as 50 per cent of rails. This gives the ohmic resistance of four rails in multiple between two sub-stations (average 17,100 ft.), as .09 ohm, and the corresponding resistance of copper as .159 ohm, or a total resistance of .25 ohm.

Each sub-station has three 650-kw converters (one as spare) and ten 240-kw transformers. The high-potential lines consist of two cables No. 0 B. & S. (one of which is spare) for each of the two distant stations and two cables No. 3 B. & S. for the two nearer stations.

Distance between sub-stations equals 17,100 ft.

The transformers have 2 per cent *I. R.* loss and 1 per cent core loss. The converter has 94 per cent efficiency over considerable range of loads. The generating station has four 1600-kw generators (one as spare) and engines.

Neglecting losses, we find that—

	Kilowatts.
Average load in kilowatts on one sub-station is...	760
Maximum load on one sub-station is.....	1600
Average load on the generating station is.....	3040
Maximum load on the generating station is.....	4400

This brings the average actual load on a rotary converter to 832 kilowatts.

Maximum load on rotary conveter.....	1910
Average load on generating station.....	3650
Maximum load on generating station.....	5650

The converters run at 64 per cent load at average load.
The converters run at 146 per cent load at maximum load.
The generators run at 76 per cent load at average load.
The generators run at 118 per cent load at maximum load.

B. *Alternating-Current Motors with Rheostatic Control.*—The motors are supplied power from four sub-stations at an average potential of 3000 volts over two sets of three-trolley wires, No. 00 B. & S. (interconnected). Each sub-station has four 700-kw transformers (one to spare). The high-potential lines are two sets of No. 00 B. & S. and No. 2 B. & S., respectively, for the longer and shorter distances.

The generating station has five 1800-kw three-phase 11,500-volt generators and five 1700-kw steam engines.

From load diagrams it is found that neglecting losses—

	Kilowatts.
Average power on sub-station is.....	1290
Average k. v. a. "	1515
Maximum power "	2300
Maximum k. v. a. "	2800
Average power generating station is.....	5150
Average k. v. a. " "	6060
Maximum power " "	7100
Maximum k. v. a. " "	8300
This gives an average kw output of power station..	5600
" " k. v. a. " " " ..	6500
" maximum kw " " " ..	7780
" " k. v. a. " " " ..	8880

The generators will run at 90 per cent load at average load.
The generators will run at 123 per cent load at maximum load.
The engines will run at 92 per cent load at average load.
The engines will run at 126 per cent load at maximum load.

C. *Alternating-Current Motors, Concatenated Control.*—The secondary network is laid out as in previous case, but the high-potential lines are duplicate sets of No. 000 B. & S. and two No. 000 B. & S. cables in multiple for the shorter and longer distances, respectively.

Each of the four sub-stations has four 800-kw transformers. The power station has five 2000-kw generators and five 1700-kw engines.

From load diagram it is found that neglecting all losses—

	Kilowatts.
Average power on sub-station is	948
Average k. v. a. "	1660
Maximum power "	2000
Maximum k. v. a. "	3500
Average power on generating station is.....	3800
Average k. v. a. " "	6650
Maximum power " "	6000
Maximum k. v. a. " "	10000
This gives an average kw output of power station..	4170
" " k. v. a. " " " ..	6850
" a maximum kw " " " ..	6000
" " k. v. a. " " " ..	10000

The generators will run at 85 per cent load at average load.
The generators will run at 125 per cent load at maximum load.
The engines will run at 75 per cent load at average load.
The engines will run at 107 per cent load at maximum load.

The selling prices of the various items referred to are assumed as follows:

Complete steam equipment, including installation, per kw	$75.00
High-potential generators, switchboards and instruments, per kw.	26.00
Rotary converter sub-stations and apparatus, per kw.	40.00
Transformers (700 kw.), per kw.	4.50
Direct-current electric locomotive complete..	$15,000.00
Alternating-current electric locomotive complete.	19,000.00
Passenger coaches (70 seats)	4,500.00
High-potential cables (10,000 volts) No. 000 B. & S., per 1000 ft.	1,060.00
High-potential cables (10,000 volts) No. 00 B. & S., per 1000 ft.	930.00
High-potential cables (10,000 volts), No. 0 B. & S., per 1000 ft.	840.00
High-potential cables (10,000 volts), No. 1 B. & S., per 1000 ft.	710.00
High-potential cables (10,000 volts), No. 2 B. & S., per 1000 ft.	650.00
High-potential cables (10,000 volts), No. 3 B. & S., per 1000 ft.	600.00
Copper, per lb.	.186
Direct-current trolley construction, per mile..	900.00
Alternating-current trolley construction, per mile	1,200.00
Eighty-five-lb. rails, per ton	26.00
Track construction, per mile	500.00

EXPENSES OF INSTALLATION AND AMOUNT OF POWER REQUIRED.

A. Continuous-current motors with series parallel control.
B. Alternating-current motors with rheostatic current.
C. Alternating-current motors with concatenated control.

	A.	B.	C.
Power house steam equipment.	$480,000	$600,000	$525,000
Power house electrical equip..	166,000	234,000	260,000
	$646,000	$834,000	$785,000
Rotary converter station	$312,000	.....	.....
Transformers	.....	50,500	57,500
	$312,000	$50,500	$57,500
17 locomotives, complete	$225,000	$322,000	$322,000
68 passenger coaches	306,000	306,000	306,000
	$531,000	$628,000	$628,000
Cables, duplicate	$157,000	$172,000	$366,000
Trolley and feeder copper.....	49,000	31,000	31,000
	$206,000	$203,000	$397,000
Track construction	$109,000	$109,000	$109,000
Trolley construction	23,400	31,200	31,200
	$132,400	$140,200	$140,200
Total cost	$1,857,000	$1,856,000	$2,008,000
Average kw power required.....	3650	5600	4170
Kilowatt average loss	600	440	380
Per cent loss	16.4	7.8	9.1

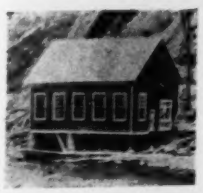
Percentage of d. c. power	100	153	114
Percentage cost of d. c. installation.	100	100	107

It is thus apparent in this particular instance, which is fairly representative for heavy urban work, that the direct-current system offers decided advantages in economy if installed at the same price as the alternating-current system, and that the same economy cannot be obtained with alternating current, no matter at which cost; furthermore, that the alternating-current system with concatenated control is preferable to that with rheostatic control. It must, however, be borne in mind that for an actual installation, practical conditions might warrant different amount of machinery and different units, and that allowances must be made for sharp turns, grades, etc., and that the prices given are somewhat arbitrary. The three systems are, however, placed on as nearly as possible the same footing, so that the comparison should be fair, even if the actual cost of the installation is considerably different.

In conclusion, Mr. Berg considers that owing to the favorable characteristics of the direct-current railway motor and the rotary converters, compared with the alternating current motor for this class of work, very few propositions warrant the use of the alternating current throughout. He considers that the stand taken by American engineers in this matter in recommending rotary converter systems almost exclusively, is correct and warranted by considerations of economy and first cost, no matter what the adverse criticisms have been of late; and that while there is undoubtedly a field for alternating-current motors, it is strictly limited to long distance schemes with very few stops, or to mountain roads.

Plant of Big Fork, Montana, Electric Power and Light Company.

By A. E. Ransom.



DURING the summer of 1900 Mr. L. Tinkel & Son, of Kalispel, Mont., started work at the mouth of the Big Fork River on the north shore of Flathead Lake, on the erection of a plant to furnish light and power to the city of Kalispel, 19 miles distant. An ideal water power exists at this point. The Big Fork River, a deep flowing stream to within a mile of the lake, falls at that point 125 ft. in a series of swift flowing rapids. At the head of the rapids a ditch capable of furnishing water for 3000 horse-power was commenced, and continued around the hill for a distance of 6000 ft., including about 3000 ft. of timbered flume. At the end of this ditch and flume a 54-inch pipe dropped down to the power house, giving a head of 100 ft. for the waterwheels, and from thence into the river.

The power house is a substantial frame building erected on the bank of the river on solid rock, and built large enough for twice the present capacity of the plant. The waterwheel equipment consists of two 300-hp Leffel turbine wheels operating at a speed of

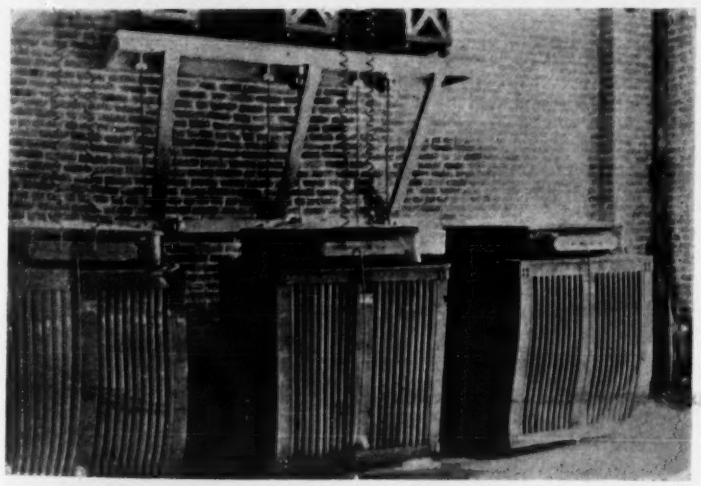


FIG. 1.—TRANSFORMERS IN SUB-STATION.

514 r. p. m. and equipped with Lombard governors. The turbines are arranged in a very compact form, as shown in the accompanying illustration. The wheels are direct-connected to two 225-kw, two-phase, 440-volt, 60-cycle, composite-wound Westinghouse alternators, the exciters of which are mounted on a platform above the turbines and belted direct to the connecting shaft. The switchboard apparatus consists of two white marble generator panels arranged for parallel operation.

The current is transformed, through a set of Westinghouse oil-cooled transformers connected on the two-phase three-phase system, each transformer being of 200 kilowatts capacity. One transformer is kept in reserve. The current is carried 19 miles to the Kalispel sub-station at a pressure of 12,000 volts at the generating end, by means of three No. 6 B. & S. hard-drawn copper wire. At Holt, three miles from Big Fork, the line crosses the Flathead River on a 700-ft. span. The transmission line, throughout the entire length follows the county road, thus rendering inspection easier.

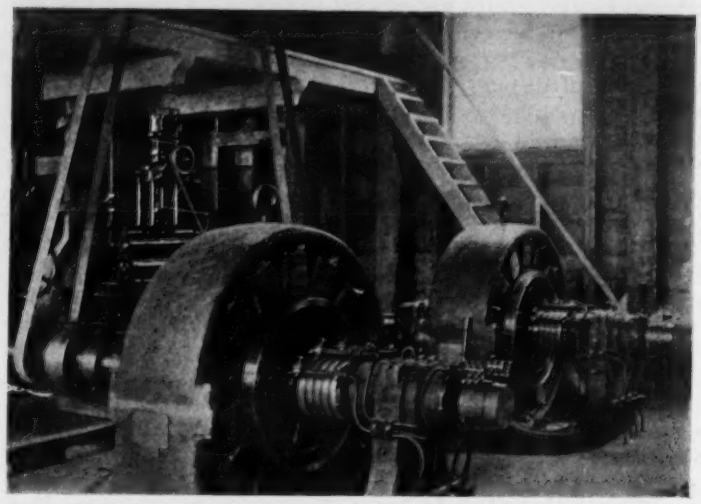


FIG. 2.—INTERIOR OF POWER HOUSE.

The sub-station at Kalispel is a substantial brick building in which there are at present installed three 200-kw Westinghouse oil-cooled step-down transformers, with 10,500-volt primaries and 2200-volt secondaries. Through two feeder panels these transformers supply the city light and power circuit.

The Kalispel Water & Light Company has contracted for 300 horse-power to operate the pumps of the city water works, and for street and commercial lighting. Three or four hundred horse-power will also be used for the supply of induction motors for operating a cold storage ice machine, 75 horse-power for the operation of the Kalispel Roller Mills, and for other motors for operating saw mill machinery, printing presses, brewery pumps, laundry work, and a number of other industries.

Plans are already under way for the doubling of the plant, which well illustrates the rapid advancement of electric transmission work in the Northwest. The hydraulic work was under the supervision of Mr. Frank B. Fish, hydraulic engineer for the company, and the electric construction under Mr. John A. Schreiner, electrician.

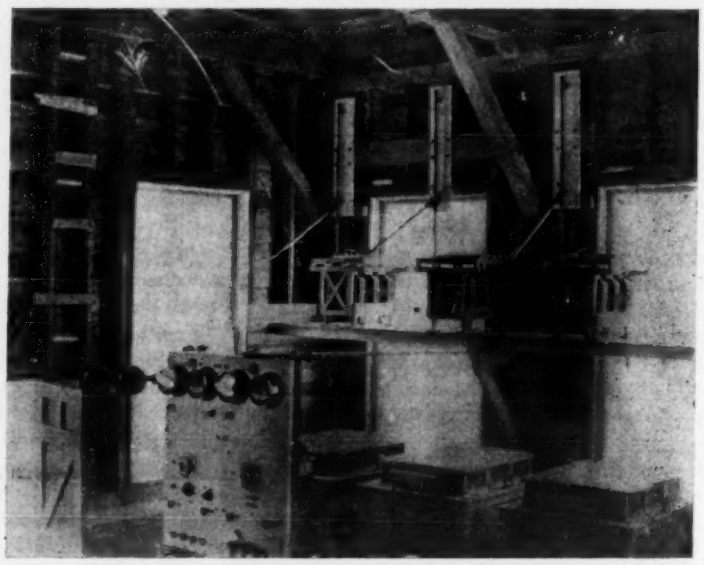


FIG. 3.—SWITCHBOARD, ETC., POWER HOUSE.

The Evolution of Exposition Lighting.

THREE very interesting and valuable articles have recently been contributed to the pages of ELECTRICAL WORLD AND ENGINEER by Mr. Luther Stieringer, consulting electrical engineer of the Pan-American Exposition, on the subjects of exposition ground lighting, electric towers and electric fountains. The data and expert opinion thus presented were summed up by Mr. Stieringer in a most suggestive paper, which he read last week before the Edison Association of Illuminating Companies at the annual convention in Buffalo. Having laid much of this matter before our readers lately, it is not necessary to repeat it, although the paper deserves to be read in its entirety as a masterly survey of a difficult branch of the lighting art.

Mr. Stieringer noted that the first decorative outdoor electric illumination was on the Gerry yacht "Electra" in 1883, with 200 incandescent lamps outlining the rigging about 2 ft. apart. The Paris Exposition of 1881 had some electric illumination. The first exposition lighted entirely by incandescent lamps was the Southern at Louisville, Ky., when 14 acres of floor space were lit by 7000 Edison 16-cp lamps, brought gradually up to full candle-power. At the St. Louis Exposition in 1884 the contract for the entire building required 5000 lamps. It was the first to have knife switches introduced; also the first to have the "cabinet" system of control and distribution. The feeders were bare copper in capped mouldings, the wire coverers at that time being unable to insulate heavy copper. Mr. Stieringer then reviewed the development at New Orleans, 1884 and 1885; Paris, 1889; Chicago, 1893; London, Earl's Court, 1894; San Francisco Midwinter, 1894; Atlanta, 1895; Nashville, 1897; Omaha, 1898, the first comprehensive and complete decorative and ground illumination by incandescent lamps, 21,000 of 8 and 16 candle-power being used. Mr. Stieringer came next, after an incidental mention of the mixed lighting in Paris, to the Pan-American, in regard to which he pointed out that its exterior illumination includes the largest vistas yet attempted at an exposition. Mr. Stieringer continued in part as follows:

To secure the results which are apparent at the Pan-American, a scheme of general distribution of illumination by 8-cp incandescent lamps entirely, is employed. All obtrusive or display lighting in the main vistas has been discouraged as detrimental to the general effect. For this reason no arc lamps are used, and for the same reason high candle-powers are avoided. It must not be inferred that a good illumination to selected conditions, cannot be effected with gas in its various forms, or with arc lights. The advantages, however, in placement alone would recommend the incandescent light above all other sources of light in Exposition illuminations. There is a general increase in the number of lights as one approaches the Electric Tower, which is the climax of the lighting scheme. To secure the best results it is essential in all artificial illumination to get uniform diffusion of light. This cannot be reached by the arrangement of a few extremely brilliant centers about the space to be lighted, because we cannot rival the sun; in fact, such an arrangement acts in itself to defeat the object to be attained. There will be a large portion of light immediately about the sources, while the remainder filters as it were, through space growing weaker and weaker as it recedes from the sources in obedience to the unvarying law of inverse squares. Methods of artificial illumination necessarily have some objections, whatever their form. For example, it is often necessary to locate lights in the line of vision. This difficulty must be met by the simple expedient of a more minute sub-division and uniformity of distribution of lamps. As a practical standard 16 to 20-cp lamps should be the largest used. From the structural and decorative standpoint to secure the best results we must have a lamp so small as compared with those now in common use, that they give but little light individually, but capable of being so grouped, massed or distributed as to produce the desired effects and diffusion without raising any point of space to a brilliancy disagreeable to the eye to rest upon. Until the present time, large units of electric light have been depended upon to bring into greater prominence the beauties of surrounding effects. But in thus using the light we fail to avail ourselves of the beauty which is inherent in the light itself when the light is secured from myriads of small units.

As electricity was the first medium to render comprehensive illumination of the grounds and buildings possible, it was but natural that impossibilities should be expected of it. The history of the Chicago World's Fair is full of vagaries and delusions that by turning on electricity the daylight might be loaded with rainbows and the night flooded with sunshine. Now, nature not only forbids such extravagancies, but true art as well as expediency and cost condemns them. The first duty of an expert in lighting is to emphasize the fact that we can but secure relative effects, the harmony of which will accomplish infinitely more than costly and laborious sensationalism. To an eye that has been fixed on the sun the glow of the incandescent lamp is a sickly yellow and the beam of the arc a ghastly blue, but coming out of the darkness into a room properly lighted by incandescents, we enjoy at once a feeling of cheerfulness.

In the case of the buildings and grounds the true principle is to outline and accentuate against the dark background of the night. Thus the imagination is given a chance, and this freedom is pleasant to all intelligent minds. The spectator whose eye is not dazzled moves comfortably about and the expenditure of electrical energy for a given result in illuminating effect is minimized.

In planning the illumination of the main setting of the Pan-American all spectacular effect was barred. Paris suffered in its last two expositions from the introduction of spectacular fountain and illuminating features in its main court. When such are presented all surrounding illumination must be under control to secure proper contrast. The illumination of the water basins or lakes and fountains therein was first introduced by the writer at the Atlanta Exposition of 1895 by placing 60 incandescent lamps on floats encircling the outer edges of the falling spray from two pyramid fountains in one of the lakes. The next development of this feature was at Omaha in 1898 when about 200 incandescent lights were placed bordering the fountain "Nautilus" and so arranged as to appear as floating on the water and accentuating the edges of the water figures or splash.

TOWER, WITH FOUNTAINS AND FLOATING INCANDESCENTS.

This same scheme has been followed on a more elaborate scale at the Pan-American, there being several thousand lights in the main fountain basin. Designs were also developed for the other basins. These were all designed to serve a double purpose—to light the water issuing from the jets and to illuminate the water in the basin for ornamental effect. Neither of these has been fully realized, the design of the water figures having been changed from the original plan, which would have given better results as it harmonized with the water figures, the lights being more scattered and in sinuous lines. As it now exists it is faulty from being too concentrated. It is composed of rings concentric to each water figure. Between each set of circles is a filling of lamps intended to represent an arrowhead, but undistinguishable because on the plane of vision. The effect is one of mass without definite arrangement or purpose.

There are important periods in the electrical requirements of an exposition. First, the prospectus outlining the scheme and scope; second, development of plans; third, construction; fourth, operation. The two latter are hard to appreciate unless one is familiar with all the details, for upon their execution depends success.

The engineer who designs the illumination of an exposition has by no means an easy task. It is not simply a question of circuits, though that is no child's play, for a distribution to as many lamps as there are at the Pan-American, nor is it a question of placing a light here and there for immediate use. The expert on illumination must be able to see in the mind's eye the effect he will produce when the exposition is at a stage when the grounds are barren and the architectural features are but little further advanced than in sketches. The prospectus

and preliminary report of the lighting of the Pan-American was of necessity prepared from such meager data and yet substantially all the electric and fountain requirements were anticipated therein.

It may be said success in designing illumination must depend largely on artifice. It does, but not of the kind that betrays itself. The artist upon light looks upon any subject just as a painter does upon a landscape. He has to compose a perfect picture by means of the disposal of illumiantion, and he must be judged by the resultant whole. For example, to erect huge wooden masts outside the buildings would dwarf the structures. To make each building a blaze of light would blot out the grounds. A sea of light in the paths and lawns would reduce the buildings to islands of darkness, so that the study of distribution and diffusion becomes for a lighting expert not only a severe problem, but a fascinating and absorbing pursuit. In dealing with questions of light for strictly utilitarian purposes, means must be adopted quite different from those that promise success in spectacular displays, but the result is ever a matter of guesswork. The experiment is much the same as the firing of modern artillery. Each shot is so costly and so irretrievable when fired that native genius and prayerful study must be taxed to the full in advance to insure the hitting of the mark. It will be seen at once how extremely difficult it would have been to change the plan of lighting the Pan-American after adoption, and, therefore, how much experience and forethought must have gone into it in advance.

While the building art has derived expression from the ancients, yet in our time we have few new conceptions but many poor reproductions. The illuminating results achieved at the Pan-American are the work of the scientists, inventor and engineer, without whom the old vessel of fat, the source of light of our ancient friends, would still hold sway.

Lighting is not a matter strictly for architects nor engineers, but a special art and a subject of special investigation. Whatever beauty the architecture may possess, if a funereal aspect is to be presented on occasion, the mourning colors of the country must be chosen, be they white, yellow or black. If the occasion be festive and in daylight, bunting in the skilled hands of the decorators will secure a festive transformation. To make a scene festive at night, it can only be by the aid of illumination.

Interference or meddling before the completion of the original scheme of the electrical work was avoided as much as possible at the Omaha Exposition. No one other than the designer and constructor knew what to expect of the illumination until the first trial, which then proved satisfactory to the management as well as to the public. There was considerable meddling with the work in hand by outside influences, at the Pan-American Exposition and at the Chicago World's Fair. This resulted in the abandonment of many good features and the neutralizing of others. As an instance of this, a continual harping for gas torches along the canals (a repetition of an abandoned experiment at Chicago) resulted in their being finally introduced at the Pylon embankments. This is an age of electricity, and we are not handicapped as Nero and the ancients were in their illuminations.

In closing this paper a few remarks are in order on what the future may show in exposition lighting, if the experiences of the past are heeded. Experience has demonstrated that the future successfully illuminated exposition will use a small unit of light, well diffused and of pleasing color, the unit to be well distributed. All concentrated light will be avoided unless the concentration is accomplished with the smallest practicable unit so that the volume does not exceed the general intensity established. Especially is this essential if displays of emblems or other artistic creations are introduced. These must not mar the actual illumination. Where spectacular effects are desired they must be so related to the whole as not to become obtrusive. Light is only relative. The expert on illumination must ever remember this, and never spoil the beauty and efficiency of a general scheme by objectionable lighting which dwarfs all surrounding illumination.

Another Canadian Water Power.

Messrs. Clark Bros., of New York, have purchased a water power on the St. Marguerite River, near Seven Islands, on the north shore of the St. Lawrence, and in the province of Quebec. It is the intention to build a large pulp mill at the latter point, which will be operated by electric power generated at the Falls. During the next two years half a million dollars will be expended in the work of development, and eventually $3,000,000 will be invested.

Annual Meeting New York State Street Railway Association.

The New York State Street Railway Association held its nineteenth annual meeting at Rochester on Sept. 10 when, as usual, there was an excellent attendance and the presentation of a good batch of technical papers supplemented by an admirable address from President Rogers. He stated that the street railways of this State had carried during the past year over 1,000,000,000 passengers, and that the net earnings from operation had been the same as in the previous year, $.0155 per passenger. The increase in the freight and express business on trolley roads had been nearly $50,000 over the previous year. Mr. Rogers discussed the difficulty that the smaller roads had to maintain expenses, for whereas only a decade ago a horse car with straw on the floor was accepted, now the public demanded everywhere the best accommodation that the resources of the art and of luxury could provide. He, therefore, insisted that such roads ought to be relieved as much as possible from the heavy penalties imposed upon them in the shape of burdensome taxation, paving and requirements for expensive construction, and he objected to the unfairness of the law taxing street railways 1 per cent on gross earnings while other public corporations are taxed only ½ of 1 per cent.

One interesting suggestion by Mr. Rogers was with regard to bringing the direction of travel on a street in harmony with the practice in Canada and England, so that when the travel was reversed the left hand would hold the car. He said: "I would suggest, if the tread of travel on our streets could be reversed, it would be a saving of many accidents. Nearly all persons, especially the ladies, in alighting from a car use the right hand to steady themselves, and upon alighting they find themselves facing backward. This benefit would also apply to the general public, as the same habit exists in alighting from a carriage. If travel was reversed the left hand would be used as a support in alighting and then the dress or parcel would be carried by the right hand of the passenger, who would face in the direction in which the vehicle was going. This is the custom in England and Canada, and if this radical change could be brought about in this country, I believe it would be of great benefit to our street railways in preventing accidents."

Among the papers read was one by Mr. Maurice Hoopes on the subject of third-rail construction. He recommended this as cheaper than the ordinary trolley system as well as more desirable for high-speed roads operating over their own right of way, as, for example, in the Albany & Hudson road, with which he was recently connected. Three objections are usually alleged against the third-rail system, viz., danger of accidental contact with the third rail, loss of power through leakage and the coating of the rail with sleet in winter. As to the first danger, Mr. Hoopes thinks there is nothing in it, provided the company fences in its tracks and runs its cars over cross-roads by momentum. The second objection, that of leakage, was not taken up by Mr. Hoopes, but he admitted that a good deal of trouble had been given by sleet, and that a satisfactory disposal of this trouble had not yet been found in the shape of an entirely satisfactory sleet cutter. Mr. Hoopes recommended for the location of the third rail a distance of 26 inches outside the outer track rail, as in the case of the Albany & Hudson, the insulator being mounted upon specially long ties inserted at regular intervals, 10 ft. being a good spaceing with heavy rail, and the special ties being 9 ft. 3 inches long. The rail recommended by him calls for only .09 per cent of carbon, .44 per cent of manganese, .088 of phosphorus and .08 per cent of sulphur. There had been no creeping of the rail on the Albany & Hudson, although the track had been down for some 15 months, and some of it was laid on 3 per cent grades. Mr. Hoopes said that he would advocate varying the size of the rail within the limits obtainable from the rolling mills to give the carrying capacity required. On the average high-speed interurban road an 80-lb. rail gives approximately the desired conducting capacity with sub-stations located at the usual intervals of from 10 to 12 miles, so that no overhead copper would be required in the nature of feeders, and the copper would be limited to the high-tension lines. Mr. Hoopes had been in the practice of bonding 80-lb. rail with 425,000 circ. mil. copper bonds put in the base of the third rail because of the absence of any interference from splice plates. As to the higher cost of the trolley over the third-rail system for the same work and equivalent conditions, Mr. Hoopes put it not less than 23 per cent for one mile of track, the

cost of third-rail construction being $3,410, and of trolley construction $4,421.

Mr. Alfred Green, master mechanic of the Rochester Railway Company, presented a paper which was an argument against the present system of rail bonding, and advocated the return to the use of a supplementary. In the course of his paper he said: "Thousands of dollars have been spent upon this bond system, and with all of our years of experience we are practically no further advanced than we were years ago, and in order to get the results that we desire we must do one of two things. Either make the rail itself continuous, something that can be done in paved streets by electrical welding, or else come to a continuous copper circuit without running the risk of broken joints. There is no doubt in my mind but that we will come yet to a supplementary wire, perhaps run a tile duct beside the rail, and have enough connections to that rail to make the circuit complete under all circumstances. If we would use a copper wire wherever that wire is attached to the rail, both wire and rail could be amalgamated, so that there is no possible chance for corrosion. I cannot, and never will, believe that you can bond the joints of the rail, no matter what cross section that rail may have, so that it will be a perfect success, and until we get out of our present way of doing things there will always be an opportunity for controversy. We must make our negative side of our circuit just as complete as our positive side, and when we do that we will wonder why we have not saved the many thousands of dollars that have been spent in trying to utilize that which has cost all street railway companies no end of trouble."

An interesting paper was presented by Mr. Charles R. Barnes, electrical expert of the New York State Railroad Commission, on brakes for electric street surface cars. He referred to the public tests of brakes made some time ago by the Railroad Commission, and said that to-day there is hardly a street railway in this State that has not some of its cars equipped with improved brakes, while the proportion of the 9000 passenger cars on surface railroads in this State equipped in this manner is constantly being increased. Mr. Barnes referred to a number of brakes in use, and as to electric brakes said that the only one used to any extent is that known as the General Electric, in which two disks lock magnetically. He said: "The most efficient brake for safety and economy is the one which nearly brings the wheel to a stop, and yet does not actually stop its revolution. This, in the cases of the air, the friction, the Sterling and the rail and wheel brake, depends upon the skill and carefulness of the motorman. In theory the principle upon which the General Electric brake is constructed approaches this condition more nearly than any of the others. On this theory the power for the operation of the brake decreases as the speed of the axle diminishes, to a point where it is nearly at a standstill, when there is no current produced and the braking power is removed. This allows the momentum of the car again to revolve the axle, when the same operation is repeated. If a brake could be constructed which would, in actual operation, produce the results which this theory holds forth, it would be the ideal brake as far as controlling the movements of a car by means of wheel friction. A brake which would operate in this manner would do away with that costly element in the operation of electric roads, flat wheels. With the use of the air, friction or Sterling brakes, as at present constructed, the number of flat wheels depends almost entirely upon the experience, skill and judgment of the motorman. The ideal emergency stop of an electric car, to prevent an impending accident, should be made in the shortest distance possible. This should be accomplished at a rate which will not fracture or pull out the king-pins of the car, nor throw passengers from their seats. The device which best fulfils these conditions will most nearly approach the much needed and much sought for perfect brake." This paper was discussed by a number of the members, and the importance of frequent brake inspection was very forcibly brought out.

Mr. W. J. Davis, Jr., presented a brief paper on the use of series boosters in connection with street railways, and said: "Experience has determined that the maximum departure of the booster characteristic from a straight line at fractional loads, referred to full-load voltage as a basis, should not exceed the values given below.

"To illustrate: A 300-volt booster, according to the table below, should have a characteristic departing not more than 30 volts from a straight line, so that, at partial load, the maximum potential upon the line would not exceed 605 volts, with 575 volts at the generator bus-bars. There is a practical limit to the amount of this variation, which is fixed by economical requirements in the electrical design of the booster. This limit is about 10 per cent, and consequently, where the boosting potential exceeds 300 volts, the resistance of the feeder should be made such that the IR drop is 5 per cent, or possibly 10 per cent greater than the booster voltage. This provision will result in preventing injuriously high voltage at the lamps and motor

Full-load voltage of booster. *Volts.*	Maximum variation in characteristic curve. *Per cent.*
50 to 100	20
100 to 150	15
150 to 250	12½
250 to 500	10

at the expense of a small reduction in line potential, which is not of sufficient magnitude to seriously affect the schedule speed of the cars."

He added: "Economically considered, the booster simply affords a means of saving line copper by drawing on the coal pile, and it ceases to be economical when the cost of power lost exceeds the interest on the additional copper required by a direct feed. Every case involving the permanent installation of a booster requires thorough study, and consideration should be given not only to the question of economy, but to probable future increase in the traffic and to extensions of the line. The chief objections to the booster as a permanent fixture are the inability of the machine to respond to demands greatly exceeding the requirements for which it may have been designed and the limitations to the area to be covered. In many cases full investigation of all the elements entering into the problem will show the alternating-current system employing a rotary converter sub-station to be preferable to a booster, especially where the service is to continue for several months in the year. There are even occasions when such service as that existing at race tracks, usually lasting only 10 or 15 days, may best be handled by a portable sub-station consisting of a rotary converter and static transformers mounted on a flat car and operated from a high-potential, three-phase transmission line."

An interesting paper was presented by Mr. F. E. Morse, superintendent of power, on the application of batteries on the Brooklyn Heights Railroad Company's system. The company has an equipment of three sets of Chloride accumulators, each of 248 cells, and Mr. Morse presented some curves exemplifying their utility. One of the sets is portable, installed in seven discarded passenger cars. It is used on the Brighton Beach line in summer and at East New York in winter.

Annual Meeting of the Association of Edison Illuminating Companies.

THE seventeenth annual meeting, twenty-second convention, of the Association of Edison Illuminating Companies, was held in the New York State Building, on the grounds of the Pan-American Exposition, Buffalo, Sept. 10-12, 1901. President John W. Lieb, Jr., of New York, presided, and delivered an interesting address, which embraced a resume of the minutes of the past conventions of the association, giving in this way a history of the progress of the association and the development of electric lighting. The following named new members were elected: Chattanooga Light & Power Company, Chattanooga, Tenn.; Edison Electric Illuminating Company, Hazleton, Pa.; Citizens' General Electric Company, Louisville, Ky.; Cumberland Electric Light & Power Company, Nashville, Tenn.; Norristown Electric Light & Power Company, Norristown, Pa.; Peoria General Electric Company, Peoria, Ill.; Sacramento Electric, Gas & Railway Company, Sacramento, Calif.; Trenton Light & Power Company, Trenton, N. J.

The programme of the convention carried out was as follows:

The first paper read was by Mr. Luther Stieringer on the "Evolution of Exposition Lighting." It is abstracted elsewhere in this issue. The lamp committee reported, and lunch was then served in the New York State Building. After lunch, Mr. F. W. Willcox read a paper on "Timely Lamp Topics," and Mr. C. P. Steinmetz gave a brief talk on methods of producing light. Dr. C. H. Sharp read a valuable paper on "Spherical Candle-Power of Incandescent Lamps." The evening was devoted chiefly to viewing the light effects on the Exposition Grounds.

On Wednesday at the morning session Messrs. L. A. Ferguson and A. Williams presented notes on their European trip this year.

Mr. W. S. Clark read a paper on the "Selection of an Insulated Cable for Lighting or Power Service," which was followed by a topical discussion started by Mr. A. Dow. Then came lunch and a trip to the Falls.

On Thursday morning the meter committee reported, and Mr. J. F. Gilchrist read a paper on "Competition with Isolated Plants." A paper was then read by Mr. A. S. Knight on "Modern Electric Light Accounting." After lunch the automobile and switch standardizing committees made their reports, and Dr. A. E. Kennelly discussed the Edison storage battery. Mr. P. Torchio read a paper on "The Economy of the 220-volt three-wire system," and Mr. C. D. Haskins gave one on "Progress in Electric Switch Design." This virtually closed the technical work of the convention.

Mr. A. S. Knight, in his interesting paper on "Modern Electric Light Accounting," expressed himself as not being very sanguine of success in the introduction of a uniform system of accounting for electric light companies, and that the desirability of a uniform system is at present more or less overrated. The distribution of accounts offer so many opportunities for individual opinion that he is skeptical as to the success of any effort for complete uniformity. Furthermore, local conditions will always so influence certain costs that comparisons of details can never be depended upon unless these conditions are taken into consideration. Again, many of the electric lighting companies have not yet been emancipated from the old systems of bookkeeping, and missionary work must be done in this field before the adoption is possible of an elaborate system of accounting. The paper describes in detail the system of accounting of the Boston-Edison Company, an abstract of which portion will appear in a following issue.

Mr. Clayton H. Sharp, in his paper entitled "Spherical Candle-Power of Incandescent Lamps," treated the subject under the following heads: Significance of mean spherical candle-power, mean spherical candle-power and the rating of lamps, mean spherical candle-power and illumination, approximate methods of determining mean spherical candle-power.

The results are given of photometric tests of seven different incandescent lamps, each having a different form of filament. It is shown that if the horizontal candle is the same for all seven lamps, the mean spherical varies from 12.82 candle-power to 15.72 candle-power, and the end-on candle-power from 5.06 to 15.9; also, that the ratio of mean spherical to mean horizontal candle-power varies from .802 to .983, while the ratio of mean spherical to end-on candle-power varies from .864 to 2.54. The above data indicate that the introduction of a system of rating according to end-on candle-power would only exaggerate the objections to the present method of rating. Assuming that all the seven lamps had been rated at 3.1 watts per horizontal candle-power, on this basis all but two of the types of lamps tested were rated low. On the basis of mean spherical candle-power the consumption varies from 3.12 watts per candle to 3.81 watts per candle. It is clear from these data that there must have been very considerble differences in the temperature of the various filaments tested; that the color of the light must be slightly different and their useful lives must vary widely from each other. Yet according to the present method of rating they were all lamps of 3.1 watts per candle.

After considering the various factors entering into the rating of lamps the conclusions arrived at are that the mean spherical candle-power furnishes the only entirely fair basis for comparing incandescent lamps with each other. On the other hand, we must be careful that the same source shall be used in comparing incandescent lamps with other lamps, as the former are placed at a disadvantage in nearly every case if the comparison is made on any other basis. This is particularly true in comparisons with arc lamps and also with the Nernst lamp. In one form of the latter lamp the supports, heaters, etc., are such as to furnish a fairly good reflecting surface behind the incandescent rod. This lamp shows, when measured in the direction of the maximum candle-power, a much higher efficiency than the best incandescent lamp, but we shall not know what its true value really is as a source of light until comparison is made on the basis of mean spherical candle-power.

It is pointed out that in determining the illumination on any surface from which there is reflection, the total luminous flux or the mean spherical candle-power is a factor of very great importance, as the illuminated surfaces in themselves become a source of illumination. Calling P the luminous flux and f the mean coefficient of reflection, it is shown that the total flux of light is $P/(1-f)$. In case of whitewashed walls the value of f is about .8, and the expression has the value of 5. That is to say, the available luminous flux is increased five-fold by the reflecting power of the walls.

As to the employment of a spherical reduction factor to obtain the ratio of the mean spherical to the mean horizontal candle-power, it is stated that this factor is not constant in the various types of lamps; consequently a different value must be used for each type, and the method thus offers no direct means of comparing the mean spherical candle-power of lamps of different types. The following empirical equation is given for computing mean spherical candle-power from mean horizontal and end-on readings: 0.7 mean horizontal candle-power + 0.3 end-on candle-power = mean spherical candle-power. By this equation the mean spherical candle-power of any ordinary type of lamp can be computed with a fair degree of accuracy from two measurements. This equation can evidently be used in other ways than the one indicated. If, for instance, the horizontal candle-power and the spherical reduction factor are known, the end-on candle-power can be computed approximately.

The results are given of some experiments made to test the recommendation of the National Electric Light Association, that incandescent lamps be rated according to candle-power measurements made on a rotating lamp inclined at an agle of 45 degs. The results showed that this method has little except its simplicity to recommend it, and that it consistently underrates the mean spherical candle-power of lamps so tested.

Measurements were also made to test the Liebenthal method, in which the lamp is measured inclined at two angles, one above and one below the horizontal, the angle in each case being 51.8 degs. The test was favorable for the method, and, in conclusion, it was stated that this method seems likely to furnish a practical procedure of rating lamps according to mean spherical candle-power. In practice the light emitted by the rotating lamp in two zones could be received by mirrors which would throw the images of the lamp simultaneously along the photometer bar. The measurements made would thus be twice the mean spherical candle-power of the lamp.

A much simpler arrangement which should be capable of yielding good results consists of two mirrors set at right angles to each other and inclined 45 degs. to a horizontal axis, which is so placed as to point toward the photometric center of the lamp. By inclining the angle of these mirrors properly, the required images of the lamp are visible from this position of the spot box of the photometer. A screen should be interposed to cut off direct light from the lamp, and the lamp should be rotated in the usual manner. The distribution of light by the mirrors can be taken account of by setting a working standard with respect to the reference standard placed between the mirrors, which must then be placed so the two horizontal images of the lamp are seen. With this method it is possible to get measurements of the mean spherical candle-power which will approximate as closely to the real value as actual measurements of mean horizontal candle-power.

New officers were elected as follows: President, Louis A. Ferguson, Chicago; vice-president, A. W. Field, Columbus, Ohio; treasurer, Alex Dow, Detroit, Mich.; secretary, Walter H. Johnson, Philadelphia; assistant secretary, Wilson S. Howell, New York. Executive Committee: Louis A. Ferguson (chairman), Chicago; Charles L. Edgar, Boston; John W. Lieb, Jr., New York; W. C. L. Eglin, Philadelphia; Thomas E. Murray, New York; Samuel Insull, Chicago, and the following *ex officio* members: A. W. Field, Alex Dow and Walter H. Johnson.

The Association provided luncheon at the meeting room each day, and also furnished the delegates with special cars for the "Gorge" ride, down the Canadian and up the American side, with dinner at the International Hotel, Niagara Falls, and a view of the Rapids illuminated by searchlights. The visit to the Falls took place on Wednesday afternoon and evening.

On Thursday evening the delegates were the guests of the Buffalo General Electric Company at Alt Nurnberg, on the Exposition Grounds, where a banquet was served to the ladies and gentlemen. The occasion was enjoyed by all, and remarks were made by Messrs. Huntley, acting as toastmaster, Lieb, Ferguson, Stetson, McCall, Price, Dow and Charles W. Price.

The place for the next meeting will be decided by the executive committee.

The following concerns were represented:

NEW YORK EDISON COMPANY.—T. E. Murray, J. W. Lieb, Jr., A. Williams, C. W. Rice, R. A. Carter, H. M. Edwards, P. Torchio.

BOSTON EDISON COMPANY.—A. S. Knight, R. S. Hale, W. H. Atkins, H. D. Kimball.

ATLANTA EDISON COMPANY.—W. Bloxham, G. W. Brine.

CHICAGO EDISON COMPANY.—S. Insull, L. A. Ferguson, L. Stieringer, O. J. Bushnell, J. F. Gilchrist.

DETROIT EDISON COMPANY.—J. H. Bissell, A. T. Hunt, A. Dow, H. Post.

ST. PAUL EDISON COMPANY.—H. L. Doherty, H. J. Gille, A. P. Lathrop.

YORK, PA., EDISON COMPANY.—J. F. Dusman.

BROCKTON, MASS., EDISON COMPANY.—H. T. Edgar, A. W. Leonard.

WILLIAMSPORT, PA., EDISON COMPANY.—E. H. Davis.

DES MOINES EDISON COMPANY.—H. W. Darling, R. H. MacMullan.

BUFFALO GENERAL ELECTRIC COMPANY.—C. R. Huntley.

UNITED ELECTRIC LIGHT & POWER COMPANY, BALTIMORE.—G. K. Hutchins.

WASHINGTON POWER COMPANY, SPOKANE.—D. L. Huntington.

THOS. A. EDISON.—DR. A. E. KENNELLY.

TRENTON, N. J. EDISON COMPANY.—P. Leipke.

NEWPORT ILLUMINATING COMPANY, NEWPORT, R. I.—G. R. Magner.

PHILADELPHIA ELECTRIC COMPANY.—J. B. McCall.

GRAND RAPIDS EDISON COMPANY.—D. McCoy, A. F. Walker.

RENOVO, PA., EDISON COMPANY.—F. M. Noecker.

ERIE, PA., EDISON COMPANY.—T. G. O'Dea.

INDIANAPOLIS LIGHT & POWER COMPANY.—C. C. Perry.

KANSAS CITY ELECTRIC LIGHT COMPANY.—R. H. Pierce.

NEW BEDFORD, MASS., EDISON COMPANY.—C. R. Price, G. R. Stetson, F. Taber.

ROCHESTER GAS & ELECTRIC COMPANY.—G. A. Redman.

TIFFIN, OHIO, EDISON COMPANY.—C. B. Rodgers.

LAMP TESTING BUREAU.—C. H. Sharp.

BROOKLYN EDISON COMPANY.—W. W. Freeman.

ALTOONA, PA., EDISON COMPANY.—E. B. Greene.

PHILADELPHIA EDISON COMPANY.—W. H. Johnson, G. R. Green, W. C. L. Eglin, J. D. Israel, J. T. Maxwell.

COLUMBUS, OHIO, EDISON COMPANY.—A. W. Field, L. G. White.

TOLEDO, OHIO, EDISON COMPANY.—E. J. Bechtel.

CHATTANOOGA LIGHT & POWER COMPANY.—B. T. Burt.

EDISON SAULT STE. MARIE COMPANY.—W. Chandler.

CLEVELAND, OHIO, ELECTRIC ILLUMINATING COMPANY.—M. E. Turner.

GENERAL ELECTRIC COMPANY.—W. S. Andrews, I. I. Baker, M. J. Bassett, W. Le Roy Emmet, E. E. Gilbert, E. H. Mullin, C. D. Haskins, W. S. Clark, F. P. Cox, J. P. Felton, H. W. Hillman, J. W. Howell, W. S. Howell, C. T. Hughes, F. M. Kimball, J. R. Lovejoy, A. C. Parsons, A. L. Rohrer, P. F. Sellers, C. P. Steinmetz, B. E. Sunny, F. G. Vaughen, F. W. Willcox, G. L. Thompson, A. G. MacAndrew.

Dr. W. M. Habirshaw was present in the interests of the India Rubber & Gutta Percha Insulating Company.

President McKinley on Telegraphy and Cables.

Last week while Mr. McKinley lay upon his bed of sickness and while hope of recovery was still strong, comment was made in these pages on his references to telegraphy and the Pacific cable, in the address which he delivered at the Pan-American Exposition, the day before his abominable assassination there by a vile anarchist. Those utterances have now a deeply pathetic and historical interest, and we believe that our readers will be glad to have them quoted in full. Mr. McKinley, with no idea that the attack on his own life would be the next confirmation of his remarks, said:

"Isolation is no longer possible or desirable. The same important news is read, though in different languages, the same day in all Christendom. The telegraph keeps us advised of what is occurring everywhere, and the press foreshadows, with more or less accuracy, the plans and purposes of the nations. Market prices of products and of securities are hourly known in every commercial mart, and the investments of the people extend beyond their own national boundaries into the remotest parts of the earth. Vast transactions are conducted and international exchanges are made by the tick of the cable. Every event of interest is immediately bulletined.

"The quick gathering and transmission of news, like rapid transit, are of recent origin, and are only made possible by the genius of the inventor and the courage of the investor. It took a special messenger of the Government, with every facility known at the time for rapid travel, 19 days to go from the city of Washington to New Orleans with a message to General Jackson that the war with England had ceased, and a treaty of peace had been signed. How different now. We reached General Miles in Porto Rico by cable, and he was able, through the military telegraph, to stop his army on the firing line with the message that the United States and Spain had signed a protocol suspending hostilities.

"We knew almost instantly of the first shots fired at Santiago, and the subsequent surrender of the Spanish forces was known at Washington within less than an hour of its consummation. The first ship of Cervera's fleet had hardly emerged from that historic harbor when the fact was flashed to our capital, and the swift destruction that followed was announced immediately through the wonderful medium of telegraphy.

"So accustomed are we to safe and easy communication with distant lands, that its temporary interruption, even in ordinary times, results in loss and inconvenience. We shall never forget the days of anxious waiting and awful suspense when no information was permitted to be sent from Peking, and the diplomatic representatives of the nations in China, cut off from all communication, inside and outside of the walled capital, were surrounded by an angry and misguided mob that threatened their lives, nor the joy that thrilled the world when a single message from the Government of the United States brought, through our Minister, the first news of the safety of the besieged diplomats.

"At the beginning of the nineteenth century there was not a mile of steam railroad on the globe. Now there are enough miles to make its circuit many times. Then there was not a line of electric telegraph, now we have a vast mileage traversing all lands and all seas. God and man have linked the nations together. No nation can longer be indifferent to any other. And as we are brought more and more in touch with each other the less occasion is there for misunderstandings, and the stronger the disposition when we have differences to adjust them in the court of arbitration, which is the noblest forum for the settlement of international disputes."

Mr. McKinley then discussed the expansion of American trade, advocated the cultivation of reciprocity and said:

"We must build the Isthmian Canal, which will unite the two oceans and give a straight line of water communication with the western coasts of Central and South America and Mexico. The construction of a Pacific cable cannot be longer postponed."

CURRENT NEWS AND NOTES.

FILAMENTS FROM REFRACTORY OXIDES.—A most interesting application of the electric arc is described in a patent issued Sept. 10 to Rasmus Anton Nielsen, of Copenhagen, the subject matter being the manufacture of filaments or threads composed of the oxides of such earth or alkaline earth metals as have proven of value for incandescing mantles. The oxide is brought to fusion by the arc and then drawn out mechanically into threads after the manner of spun glass, the threads being subsequently woven into form suitable for the mantles, and if desired further coated with a pulverulent layer of oxides by alternate dipping and firing according to known methods. Certain precautions must be observed in the operation, for if the molten oxide be subjected to the electrolytic effect of the current a separation of metal will occur, the subsequent oxidation of which in use may disrupt the mantle, and if the vapors of the arc be permitted access to the bath some carbide will be formed, with disastrous effect when the mantle is afterward exposed to moist air or to the vapor of water which is always present in the Bunsen flame. The heating means employed is simply the tube furnace of Moissan, an open-ended carbon tube traversing a cavity in a block of lime and heated by an arc formed within the cavity and above and out of contact with the tube. The oxide to be fused is molded into a rod which is placed within the tube, and subjected to a constant longitudinal pull by an appropriate tension device attached to its ends, as, for instance, a cord pasing over a roller and supporting a weight. As the temperature of that portion of the rod nearest the arc approaches the melting point, it softens and the ends of the rod are drawn rapidly apart by the tension mechanism, forming a fine thread of oxide which is then ready for weaving into mantles and such further treatment as is deemed necessary. The method is simply the one which is familiar to every chemist who has "drawn" a glass rod over a Bunsen burner, rendered applicable, through the enormous temperature of the electric furnace, to the most refractory compounds known to chemistry.

ELECTRICAL ENGINEERS.—The Chief Examiner, State Civil Service Commission, Albany, N. Y., will receive applications up to Sept. 23, in regard to examinations for positions as electrical engineer ($900 a year, with maintenance), and assistant electrical engineer ($40 to $60 per month, sometimes with maintenance).

BROOKLYN BRIDGE.—It is stated that the report on the condition of the Bridge prepared by Mr. Duryea, as a result of the investigation following the break in the center of the structure last summer, which has been lodged in the District Attorney's office, eliminates, as we predicted, any consideration of electrolysis as a factor, and gives as the cause deterioration due to the excessive weight placed upon the structure. The statement of Mr. Ferdinand W. Roebling brings out the fact that the total load now borne by the Bridge is 5520 tons against a proper load of 1360 tons provided for in the calculations of Colonel Washington A. Roebling, the engineer and constructor of the Bridge.

ELECTRIC-RAILWAY PROJECT AT CARLSBAD.—Consul Mahin, of Reichenberg, reports that an electric street railway company, the Elektrische Strassenbahngesellschaft, has been formed at Carlsbad, Bohemia, and negotiations with supply and construction firms are invited. Carlsbad is as yet devoid of any kind of public conveyance, except cabs and hotel omnibuses, though it has a permanent population of 15,000, to which are added between April and October of every year 40,000 or more sojourners, many of whom are Americans. The city is spread out, along the Tepl River, a distance of several miles, from the railway station to the Posthof, between which points street car communication would prove a great boon to the permanent and sojourning population. Branch lines on side streets leading to the villas and hotels on the adjacent heights would also be practicable.

MANUFACTURE OF ACETYLENE BLACK.—Adolph Frank, of Charlottenburg, Germany, has patented (Sept. 10) a method for the production of finely divided carbon by interaction of an oxide of carbon and a carbide, the latter being either finely powdered carbide of aluminum or calcium, or gaseous acetylene, carbide of hydrogen. A moderate heat, not exceeding 250 degs. C., is sufficient to initiate the reaction, or in the case of the mixed gases an electric spark may be employed. The reactions of the process involve the reduction of the gaseous oxide of carbon by the hydrogen of the acetylene or by the metal of the carbide, the carbon being separated from both reacting bodies in accordance with the equations $C_2H_2 + CO = H_2O + 3C$, and $CaC_2 + CO = CaO + 3C$. If the latter reaction be employed, the carbon may be separated from the lime by elutriation and washing, and is said to form an excellent base for substitutes for Chinese (Indian) ink. The method recalls the proposal advanced by Schmole in 1894 to produce pure carbon by the reduction of carbon monoxide by means of the vapors of magnesium or silicon, and also the more recent suggestions of Hubou for putting into practical use the long-established fact that by the agency of heat, pressure and the electric spark, carbon is readily separated from acetylene and other hydrocarbons.

A NEW TYPE OF ROTARY CONVERTER.—A patent issued Sept. 3 to Messrs. Hutin & Leblanc, of Paris, France, describes an interesting type of rotary converter, the armature of which has no connection with the alternating-current line, and the speed is half that corresponding to the frequency. The converter consists of two distinct fields and two armatures on the same shaft. The winding of one of the fields is connected to the alternating-current line and the other field is excited, as in the case of an ordinary rotary converter, with direct current taken from the direct-current side of the machine. Any conductor of the armature within the alternating-current field is so connected with a conductor of the armature in the direct-current field, that the two conductors lie at an equal angle on opposite sides of a plane of symmetry revolving with the armature. By this method of connection and the use of two fields, the speed of the armature is but half that of a rotary converter of the usual type operating with the same frequency. This reduction in speed follows from the fact that the armature is driven in an opposite direction to that of the rotary field produced in the alternating-current side of the converter. One great advantage of this is that it permits the use of double the number of coils in the armature with a given commutator, or half the number of commutator segments with a given winding, as compared with the ordinary rotary converter. This naturally facilitates commutation and permits of the easy production of direct-current of high potential. Another important advantage is that owing to the method of winding, the armature is fed by as many distinct alternating currents having regularly displaced phases, as there are segments in the commutator, and there can consequently be no variation of flux in the armature sufficient to injuriously affect the commutation. The application of the principle of this converter to single-phase circuits is described, in this case the magnetic screen of squirrel-cage construction of the same inventors being used.

FREQUENCY INDICATOR.—Messrs. C. C. Chesney and W. J. Lloyd, of Pittsfield, Mass., have recently patented a simple frequency indicator for both constant-current and constant-potential circuits. The principle upon which it is based is that in an electric circuit containing a device having capacity or self-induction the amount of energy flowing through the circuit varies with a varying frequency; that is, other things being constant, in a circuit having capacity the amount of energy passing increases as the frequency increases, while in a circuit having self-induction the amount of energy passing decreases as the frequency increases. The changes in frequency produce changes in impedance. Making use of these laws Messrs. Chesney and Lloyd place either a device having capacity, such as a condenser, or a device having self-induction, such as a self-induction coil, in series with an indicating device which preferably is not affected by the frequency alternation—such, for instance, as the well-known hot-wire indicating device. It will be easily seen that if a condenser is placed in series with such an indicating device and the two are connected to a source of electric current it will result that as the frequency increases the volume of current passing through these two devices will increase, and, vice versa, so that the pointer of the indicating device will have a greater deflection for a higher frequency and a lesser deflection for a lower frequency. If the voltage of the constant-potential system varies, the indications of the simple arrangement above referred to will vary for that reason also, and it will be necessary to determine the voltage of the system and calculate what part of the deflection is due to increased frequency and what part is due to change in voltage or to provide means for eliminating the error. This can be done by using either the same or a separate indicating device or by employing a differential arrangement. In the first case means are provided for connecting the indicating device alternately across the mains through suitable resistances and the energy-controlling device, and in the second case an additional indicating device is permanently connected, so as to make the readings easily taken. The necessity for taking these separate readings and making the computation can be avoided by using a differentiating arrangement, whereby the tendency to deflection caused by change in voltage opposes the tendency to deflection caused by the variation in frequency and voltage combined, giving a resultant which shall be the deflection which would be due to change in frequency alone. In the drawings of the patent, one figure shows the combination used for a constant-current circuit; the next, for constant potential; the third, a combination for circuits of variable voltage, of which the next two are modifications; while the sixth figure shows an instrument in which the effect of a varying voltage is automatically compensated for, and which will, in consequence, indicate the frequency without any computation.

LETTER TO THE EDITORS.

Phosphorus in Incandescent Lamps.

To the Editors of Electrical World and Engineer:

Sirs.—In a recent article on "Electric Lighting," published in ELECTRICAL WORLD AND ENGINEER, the writer stated that he had first proposed the use of phosphorus in exhausting incandescent lamps.

This suggestion was first made by the writer in a discussion of a paper before the American Institute of Electrical Engineers. About the same time, some experiments were made in order to give the proposd method a practical test, with good results. Later the results of these tests and of the methods used were communicated to a German chemist connected with a large electric company, and when the method was, about a year later, announced as in use in Germany, it was supposed that its introduction was connected with this episode.

My attention has, however, been called by Mr. John W. Howell, the well known expert in electrical incandescent lighting matters, who has made a special study of the history of the development of the incandescent lamp, to the fact that my statement was erroneous. Mr. Howells has pointed out that two patents were issued in England, in 1882, one to Van Cleve, describing the use of phosphorus pentachloride, the other to Cherrill, describing the use of phosphorus.

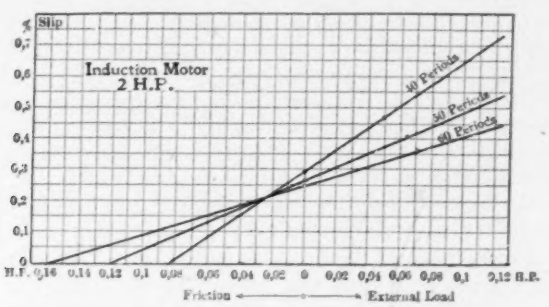
The fact that no reference to either of these patents is made in any part of the literature of the subject with which I am acquainted is the cause of the mistake. Mr. Howells has also pointed out that it is to Malignani that the credit of realizing the full advantages of the use of phosphorus is due, and that he did this in the year 1888 or 1889, though no description was published at the time. My thanks are due to Mr. Howell for putting in my hands the information which enables me to correct the erroneous statement referred to.

WASHINGTON, D. C. REGINALD A. FESSENDEN.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS

Measurement and Calculation of the No-Load Losses of Induction Motors.—BENISCHKE.—An illustrated description of a new method for determining separately the different losses in an induction motor at no load. He makes use of his stroboscopic method for determining the slip (described in the Digest, March 11, 1899; a disk mounted on the axle of the motor is lighted by an arc lamp supplied with the same alternating current as the motor. When the motor runs as a synchronous motor, the disk appears to be at rest in space. For an induction motor the disk appears to rotate at a certain speed which bears a simple relation to the slip of the induction motor). This stroboscopic method for determining the slip is very exact and enables one to determine the slip quite accurately even for a very small load or for no load. For small values of the load the slip is practically proportional to the load, that is, when the values of the slip for different small values of load are plotted diagrammatically, the points in the diagram must be in a straight line. Let this line be prolonged until it cuts the axis of abscissas which represents the load. The distance of this intersection from the zero point of the axis of abscissas, represents the loss due to air friction and to the friction of the bearings. In the adjoining diagram the results of such tests of



NO-LOAD LOSSES OF INDUCTION MOTORS.

a 2-hp motor, are given. It was tested with three different frequencies, 40, 50 and 60. For each frequency the slip was determined for no load and for two small values of the load. These three values of the slip, when plotted in the diagram, were found to be in a straight line. In this way the three straight lines for the three different frequencies were obtained. It will be seen that the friction was thus found to be 0.084, 0.121 and 0.160 horse-power for 40, 50 and 60 periods, respectively. The friction increases with increasing frequency. In this motor the slip at no load is the smaller the greater the frequency, it is 0.25 and 0.3 per cent for 60 and 40 periods, respectively. In another motor the slip at no load was found to be independent of the frequency. When the friction of the motor has been determined in this way, and when the consumption of watts at no load has also been measured, the difference of these values gives the iron loss. He gives the results of tests made by this method and discusses at some length the reasons why other methods have given wrong results.—*Elek. Zeit.*, Aug. 29.

Twenty-two Thousand-Ampere Alternator.—A note on three single-phase alternators which have been made by the Mediterranean Thomson-Houston Company for a large Italian calcium carbide plant. The alternators are driven by turbines. Each alternator supplies four furnaces in parallel. The alternators have a stationary armature and 12 poles, the capacity being 1000 kilowatts. The normal tension is 45 volts. At normal non-inductive load they give 22,000 amperes, and at inductive load, with a power factor of 0.8, they give 28,000 amperes. The armature has two windings, which can be connected in parallel or in series, to give either 45 volts or 90 volts. A single 50-kw, four-pole, 125-volt dynamo gives the exciting current for all three alternators and the lighting current for the plant. For measuring the currents, specially designed transformers are used, the coefficient of transformation being 700 to 1. The primary winding through which the total current of the alternator flows, is formed of bars of copper, and the secondary windings are wound on a laminated iron ring which surrounds the bars of the primary circuit.—*L'Ind. Elec.*, Aug. 10.

REFERENCE.

Construction of Alternators.—LASCHE.—A continuation of his well illustrated serial on the construction and systematic manufacture of alternators. He gives the theory of the tie work and discusses the economical importance of the stiffening system.—*Eng'ing*, Aug. 30.

POWER.

Brake-Releasing Electromagnets.—A note on the construction of electromagnets used for releasing the mechanical brake of electrically driven cranes. Such electromagnets were originally wound for connection in series with the motor. This arrangement worked well, as the starting current of the motor was always sufficient to ensure the action of the magnet as long as the old pattern cranes, with worm gearing and very slow hoisting speed, were in use. With the latest improvements in modern cranes, the gearing is so perfect that it is put in motion by the load alone, and there must therefore come a time when the motor current is zero. At this moment a series-wound brake-releasing electromagnet would cause a sudden and inconvenient stopping of the gear, and the use of such winding has therefore become impracticable. A compound winding was tried, but found unsatisfactory as either the pull of the magnet was insufficient, or the shunt winding was burned out. The "Helios" shunt-wound electromgnet is claimed to overcome all these difficulties, and to have the advantages of a very great pull and a long stroke. The chief feature in this new construction of brake-releasing magnet is the use of a small switch fixed to the magnet, which short-circuits a resistance, placed in series with the magnet windings, as long as the magnet is inactive. When the magnet is brought into use, the switch is opened at the last part of the stroke-movement, and the resistance inserted in the circuit, so that the current in the magnet winding is greatly reduced. The use of this switch is based on the well-known fact that the exciting current required by an electromagnet to retain its load is far smaller than that required to attract the same load from a distance. Besides the resistance, just mentioned, there is another placed in parallel with the magnet winding to destroy the induction current at switching off. The consumption of energy by this type of brake-releasing magnet is from 200 to 300 watts. The movement of the magnet core is damped by air-cushioning at either end.—Lond. *Elec.*, Aug. 30.

REFERENCE.

Wave Motors.—WALSH.—An article on experiments which have been made by the United States Lighthouse Board with wave motors, the principal object being to generate electrical energy for buoy lighting and for lighting the lamps in the lighthouses. No details of the wave motors are given, and it appears that the experiments have not been very successful so far.—*West. Elec.*, Sept. 7.

TRACTION.

Storage Battery Line in New York.—An illustrated description of what is said to be the only line running storage battery cars in America. It is in New York City, and has a length of 2¼ miles double track. Current is obtained from three 300-kw generators, driven by direct-connected induction motors operated from the 6600-volt three-phase mains of the company. The batteries are moved from the cars to the charging stations by a hoisting and transfer car, operated entirely by electric motors. The batteries are stood along both sides of a long pit on which this car runs, and the transfer to the hoisting car and on to the truck is done entirely by machinery. The battery for each car consists of 72 cells, each cell having five negative and four positive plates. The negative plates are of the chloride type. The positives are made up of spirals of prepared lead ribbon, crimped, and held in place in the supporting lead plate. By the aid of the two boosting batteries there are three charging voltages which can be taken from separate bus-bars on the switchboard. These are 164, 174 and 180 volts, respectively. The battery connections are changed from one bar to the other at the switchboard by signals sent by the operator in the charging room. The practice is to charge on the low voltage until the battery takes 60 amperes, then change to the intermediate until 75 amperes are reached, then to the high bar until the battery is charged. The speed of the cars is changed by series-parallel control of both batteries and motors. The cars have been running about nine months, and at present 46 are used during the hours of greater traffic.—*St. R'y Jour.*, Aug. 31, and Int. Ed., Sept.

Comparison of Electric Traction and Steam Traction.—CSERHATI.—Former comparisons of the relative merits of electric traction and steam traction have generally been based upon the assumption that direct current is used for the electric traction. He remarks that no direct-current system has so far been able to solve the problem of electric traction on main railways, but thinks that this problem will be satisfactorily solved by the three-phase alternating-current system with high-tension transmission and stationary transformers along the line. He thinks that the natural development will be that the steam locomotive will be replaced by the electric locomotive. He assumes for his comparison that the dynamos generating the electrical energy are driven by steam engines. The results of his comparison are greatly in favor of electric traction which, he finds, has the following advantages: Saving of fuel of at least 25 per cent; smaller weight of the electrical locomotive; possibility of regaining electrical energy when going down grades; saving in the cost of maintenance of the rolling stock and in the item of wages for the attendants; greater safety; possibility of running smaller trains at shorter intervals; possibility of using the present roadbed and track for higher speeds; an easy solution of the problem of electric lighting of the cars; absence of smoke; possibility of utilizing water powers. The only serious objection to the general introduction of electric traction is the high cost of the first installation.—*L'Eclairage Elec.*, July 27.

Norfolk & Atlantic Terminal Railway.—A long and well illustrated description of this line which does a passenger as well as a large freight business. The company is using a novel type of convertible car. The sides of this car can be lowered by means of a windlass, and it then is very similar to a closed car. When the sides are raised they slip under the roof. Trains of two or more cars each are run, and air brakes are employed on both motor and trail cars. They are operated by the motorman, and are much more satisfactory than when the brakes are operated separately.—*St. R'y Jour.*, Sept. 7, and Int. Ed., Sept.

Block Signal System on the Boston Elevated Railway.—KNOWLTON.—The main line was put in operation June 10, this year. The running time between the terminals is now 22 minutes in place of 45 or 50 on the surface, and trains have frequently made the run in less than 19 minutes, making the stops, and 16 minutes omitting the stops. There are many grades, some being 6 per cent, and several curves as sharp as 90 ft. radius. The signals are operated by compressed air, and are moved automatically by the cars. Small engravings show the local arrangement of signals at different points. A table gives a typical running time of one train.—*St. R'y Jour.*, Sept. 7, and Int. Ed., Sept.

Aeronautics and Electricity.—HOSPITALIER.—An article in which he first points out that a balloon, capable of being steered, cannot be realized. At its best, a successful trip can be made only in exceptionally good weather. On the other hand, it is still impossible to say whether a flying machine based upon the principle upon which the birds fly, can be realized. To decide whether such a machine is possible in practice one would have to begin an extended systematic study in the laboratory of the form and arrangement of the wings, the power required, etc., but there is no glory in such an investigation. Before these points have been carefully investigated, it is useless to construct motors for this purpose. The electric motor seems practical, as it can be made to have a light weight. The source of electric power would be on earth and the flying machine would have to be connected with it by light wires.—*L'Ind. Elec.*, Aug. 10.

REFERENCES.

Methods of Safety for the Overhead Trolley System.—MANVILLE.—An illustrated paper in which he first discusses the precautions to be taken to ensure solid construction. He then discusses the regulations of the British Post Office authorities regarding the arrangement of guard wires for the protection of telegraph and telephone wires. Should a trolley wire break or should telegraph or telephone wires come in contact with the live trolley wire it is essential that means should be provided for immediately rendering that particular section of the trolley wire inoperative by automatically disconnecting it from the generator. Means for this purpose are described.—Lond. *Elec. Eng.*, Aug. 30.

How to Make Non-Paying Roads Pay.—COOPER.—A continuation of his long serial. He continues the subject of standardization in this issue, and speaks first of the importance of ordering all car repair parts for a standard size. He then refers to the necessity of determining the point of ultimate wear for different apparatus, and cites as an example the journal bearings of a car. He also comments on the importance of frequent inspection of all parts.—*St. R'y Jour.*, Sept. 7, and Int. Ed., Sept.

INSTALLATIONS. SYSTEMS AND APPLIANCES.

110 vs. 220-Volt Installations.—WIKANDER.—A reply to the communication of Mueller (Digest, Aug. 24), who had spoken strongly against installations with 220-volt at the consumers' terminal. The present author remarks that the saving in the line construction is not the only advantage of the higher voltage. Other advantages are that the same dynamos can furnish current for lighting and traction and that one is less restricted in the choice of the site of the generating station. For the existing 2×110 volt installations with insulated middle wire, it would doubtless be an advantage to make necessary extensions of the distributing network with bare middle wire, in order to save cost.—*Elek. Zeit.*, Aug. 1.

REFERENCE.

Warren.—An illustrated article on the reconstruction of the water and electric lighting station at Warren, Ohio.—*Eng. News*, Sept. 5.

ELECTRO-PHYSICS AND MAGNETISM.

Magnetic Effect of Electric Convection.—WILSON.—A reply to Cremieu's criticism, recently noticed in the Digest. He maintains that his objections to Cremieu's earlier experiments hold good, and adds a remark on Cremieu's recent experiment which was supposed to prove conclusively the existence of "open currents." As has been noticed before, in this experiment a disk of ebonite 2.5 mm. thick carrying sectors on one side was rotated rapidly. Near the other side of the disk a charged metal sector was placed so as to induce charges on the sectors as they passed by it. The motion of these induced charges constituted the "open" part of the current; the charged sector was 2.5 mm. distant from the disk, and its potential was about 115 electrostatic units. The present author remarks that this potential is sufficient to produce a spark 1 cm. long, so that, of course, a brush discharge would occur to the ebonite, so that it would get a charge on the side next the fixed sector equal and opposite to that induced on the moving sectors; consequently, the total charge on the disk would be zero, and so no magnetic field would be produced.—*Phil. Mag.*, Sept.

Spark Discharge.—GUGGENHEIMER.—A note on the spark-discharge in gases relating to a recent discussion between Swyngedauw and Warburg. The present author's results confirm the views of Warburg. A comparison of the results of experiments, undertaken from different standpoints, shows that the e. m. f. per cm. which is required to give to the negative ions a velocity such that they can produce new ions by collisions with the molecules of the gas, is very nearly the same as the e. m. f. required to produce spark-discharge in the gas at the same pressure, and with the electrodes at the

distance of 1 cm. This is, for instance, proven for air at atmospheric pressure. Starting from the supposition that air at atmospheric pressure always contains ions, and that ions are continuously produced, he develops the following idea of what happens before a spark passes. If one subjects two electrodes to slowly increasing e. m. f.'s, there will be formed immediately a very feeble current, as observed by Warburg and others. This current will, so long as no external agents are acting, remain constant within very wide ranges of the e. m. f., but its intensity will increase very quickly and tend to a maximum, as soon as the e. m. f. attains the value necessary to give to the ions the velocity required to produce new ions by impact. He therefore gives the following new definition of Maxwell's "electric strength" of a gas at a certain pressure. It is "the electric intensity required to give to the negative ions a velocity sufficient to enable them to produce other ions by collisions with the molecules of the gas." The spark itself appears to amount practically to a short circuit between the electrodes.—*Phil. Mag.*, Sept.

Resistance of Bismuth to Alternating Currents.—Simpson.—An anomalous property of bismuth is the change which the resistance of a filament undergoes when placed perpendicular to the lines of force in a strong magnetic field. Not only does its resistance increase very much, but with alternating currents under these conditions it is apparently different from the resistance to direct currents. He experimented with a bismuth spiral, having a resistance of 17.88 ohms at 21 degs. C. in zero field, which was placed perpendicular to the field produced by a large electromagnet, the field strength being 17,000 gauss (lines per square cm.), so that the resistance of the bismuth in the field was double its value outside. He investigated the resistance of the bismuth to alternating currents of a frequency varying between 10 and 60 p. p. s. He found that with a frequency of 20 an effect was produced which may be represented by an alternating e. m. f. in the bismuth 120 degs. behind the current. A similar "bismuth e. m. f." is obtained with other frequencies, but of different magnitude and phase. Empirical formulas are given for the magnitude and phase of this "bismuth e. m. f." for any frequency between 10 and 60.—*Phil. Mag.*, Sept.

Oscillating Discharges Through Divided Inductive Circuits.—Miguno.—A mathematical article in which he reaches the following conclusions. In general, when a charged condenser discharges through divided inductive circuits, the current does not take a simple form as in the case of oscillating discharges in a single inductive circuit; but, if the time constants of the divided circuits happen to be equal, then the circuits may be reduced to a single equivalent inductive circuit, giving rise, under a certain special condition, to simple harmonic discharge currents. In this case also the conditions for oscillations in the main and the divided circuits are all the same. Each inductive circuit has its own period of oscillations, whose value is definitely determined by the resistance, the self-inductance and the capacity, at the ends of the circuit; however, by joining inductive circuits of equal time-constants in parallel to a charged condenser, it is possible to reduce the effective capacities of the circuits, thereby causing the latter to have the same period of oscillation.—Lond. *Elec.*, Aug. 30.

Filings Coherers.—Eccles.—The conclusion of his article, the first part of which was abstracted in the Digest last week. The method described there is called a true quantitative method of investigating the qualities of a coherer, as by the use of this method all the anomalies which have hitherto accompanied the manipulation of a coherer seem to disappear. Coherence is a continuous phenomenon, and there can be no true "critical voltage." Regarding the theory of coherence, he accepts Lodge's view of the coherence phenomenon due to chains of particles welded together; but he thinks that this is only the final action, and that there is a primary, purely mechanical action, namely, the orientation of particles. When a difference of potential, steady or oscillatory, is established between two opposed plane conductors separated by a distance which is small compared with their own magnitude, a fairly uniform electric field is created between them. Any conducting piece of matter, not spherical in shape, moving freely in this field, will experience a couple tending to place it, in general, with its longest axis parallel to the field. Other particles present will be similarly acted upon, and if they come to rest while the electric field is maintained, they may be expected to exhibit distinct orientation. In this state the process of chain forming by welding is easier than when the arrangement of the particles is fortuitous. The phenomenon of coherence has therefore two subsequent stages: The mechanical orientation of the particles and the formation of chains by weldings. Both actions are dependent upon the applied e. m. f. The article is discussed in a separate editorial. It is said that while Eccles' theory explains many observations made with filings coherers, there are others which do not seem to be explained, for instance, the action of "anti-coherers."—Lond. *Elec.*, Aug. 30.

REFERENCES.

Specific Inductive Capacity of Dielectrics.—Ladenburg.—An account of measurements of the specific inductive capacity of certain organic compounds by Drude's method. The results show that there is a relation between the specific inductive capacity and the chemical constitution of the compound.—*Zeit. f. Electrochemie,* Aug. 8.

Induction Coil.—Ehnert.—An article, illustrated by diagrams, on the calculation of the coefficient of self-induction of induction coils without iron.—*Elek. Anz.,* July 21.

Top Factor.—La Cour and Benischke.—Two communications continuing the controversy regarding Benischke's "top factor" (Digest, Sept. 8, 1900, and Aug. 24, 1901). It appears that Benischke's theory is correct.—*Elek. Zeit.,* Aug. 1, 22.

Resistance of Selenium.—Giltay.—An illustrated description of apparatus for demonstrating the effect of light upon a selenium cell, by means of the telephone.—*Phys. Zeit.,* Aug. 24.

Speaking Arc.—Ruhmer.—An illustrated description of apparatus for the demonstration of Simon's and Duddell's experiments with the speaking arc.—*Phys. Zeit.,* Aug. 31.

Electro-Chemistry and Batteries.

Carbon Electrodes.—Foerster.—An account of an investigation of the influence of carbon anodes upon the process of the electrolysis of alkali solutions, especially of common salt. The anodes are attacked in a double way—by oxidation and by mechanical destruction. The results of measurements made with 10 different kinds of carbon, are given in a table. The graphite carbons are much superior to the amorphous carbons. The porosity is also of importance. The greater the porosity the quicker the destruction of the carbon anode. —*Zeit. f. ang. Chemie,* 14, p. 647; abstracted in *Zeit. f. Elektrochemie,* Aug. 8.

Gas Battery.—Bose.—A brief paper on the reactions in gas batteries. He deals with the hydrogen-oxygen battery, and the hydrogen-chlorine battery, the first being obtained with platinum electrodes in sulphuric acid or in an alkaline solution, the second with platinum electrodes in a hydro-chloric acid solution. The reaction at the hydrogen electrode is simple, while at the oxygen electrode and on the chlorine electrode there are complications due to secondary reactions. At the chlorine electrode, for instance, the chlorine gas reacts with the water with the result that hydrochloric acid and hypochlorous acid are formed. The reaction at the oxygen electrode is still more complicated and not yet fully explained.—*Zeit. f. Elektrochemie,* Aug. 8.

Ferro-Silicium.—Morris.—He gives a brief review of the subject of the silicides of iron. The density decreases as the percentage of silicon increases, and the hardness increases as well as the fusion temperature, the range being from 1130 to 1400 degs. C. The ferro-siliciums, poor in silicon, are magnetic, but the magnetic permeability ceases when the percentage of iron no longer exceeds that of the silicon. The magnetic power can be taken advantage of to estimate roughly the composition of ferro-siliciums. He then discusses the manufacture of ferro-siliciums in the electric furnace.—*The Elec. Chem. and Met.,* Aug.

British Electro-Chemical Society.—Bousfield.—Some remarks on the possibilities of the formation of a British Electro-Chemical Society, after the manner of the Inst. of Elec. Eng. He thinks that the time has not yet come for the formation of such a society, as electro-chemistry hardly exists in Great Britain as an industry. Editorially it is suggested that the Society of Chem. Ind. and the Inst. Elec. Eng. should combine together in some way, for instance, by means of a special committee on electro-chemistry common to both.

REFERENCES.

Cells with Fused Electrolytes.—Suchy.—An account of measurements of the e. m. f. and temperature coefficient of a number of cells made up of fused electrolytes, for instance, the following which is of the type of the Daniell cell: Lead, chloride of lead, chloride of silver, silver. The chief result obtained is the perfect analogy which was found to exist between Daniell cells of fused metals and salts

and those of water solutions and solid metals.—*Zeit. f. amorg. Chem.*, v. 27, p. 152; abstracted in *The Elec. Chem. and Met.*, Aug.

Transport Numbers and Constitution.—RIEGER.—According to Hittorf, the measurement of the transport numbers enables one to determine the chemical constitution of compounds, for instance, to determine the nature of the ions. He applies this method to an investigation of certain complex salts. The method of his measurements is described and the results for potassium copper sulphate are given.—*Zeit. f. Elektrochemie*, Aug. 29.

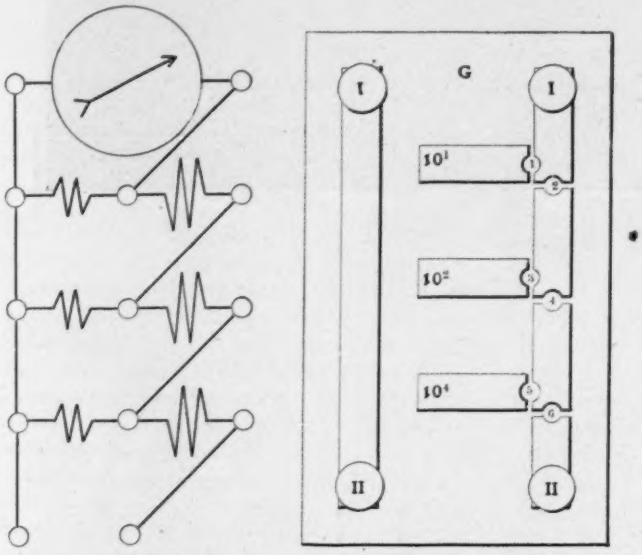
Reaction Velocity.—SIEGRIST.—A study of the velocity of electrolytic reactions. He investigated the velocity of the electrolytic deposition of copper in the presence of sulphuric acid.—*Zeit. f. amorg. Chemie*, v. 26, p. 273; abstracted in *The Elec. Chem. and Met.*, Aug.

Reduction of Nitrites.—SULER.—A long paper giving an account of an experimental investigation of the electrolytic reduction of nitrites. The paper is of interest chiefly to chemists.—*Zeit. f. Elektrochemie*, Aug. 15, 22.

Estimation of Copper in Pyrites.—HEIDENREICH.—A description of a quick and exact method for the quantitative estimation of copper in pyrites by precipitation with aluminum and electrolysis.—*Zeit. f. anal. Chem.*, v. 40, p. 15; abstracted in *The Elec. Chem. and Met.*, Aug.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Galvanometer Shunt.—VOLKMANN.—For altering the sensibility of a sensitive galvanometer, shunts are used which have a resistance equal to a certain fraction of the resistance of the galvanometer. When such a shunt is connected in parallel with the galvanometer, the joint resistance of galvanometer and shunt is smaller than that of the galvanometer alone. By adding a proper series resistance it can be accomplished that the whole arrangement has the same resistance as the galvanometer alone. To get a great increase of the range of the instrument, a larger number of shunts and series resistances is needed. He describes an arrangement which enables one to obtain with n shunts and series resistances the same number of changes of the range of the instrument, for which otherwise $2^n - 1$ are needed. His arrangement is illustrated in the adjoining diagram 1, in which the thick zig-zag lines represent the shunts, while the thin zig-zag lines represent the series resistances. Let the three shunts be 1-9, 1-99, 1-9999, and the three series resistances 9-10, 99-100, 9999-10,000 the value of the galvanometer resistance, then it will be seen that the following seven different combinations are possible with the three sets of shunts and series resistances: Either the first shunt and series resistance alone, or the second ones alone, or the third ones alone, or the first and second together, or the first and third together, or the second and third together, or all three together. This arrangement becomes very practical and easy with the use of a resistance box, as shown in Fig. 2. At the two points *I* the connections are made to the galvanometer. When plugs are inserted in the openings 2, 4, 6, the series resistances 9-10, 99-100, 9999-10,000 are short circuited. Below the numbers 10^{-1}, 10^{-2}, 10^{-4} in the figure, there are the shunts 1-9, 1-99, 1-9999. They are traversed by the current when plugs are inserted in the openings 1, 3, 5. There are altogether three plugs, the first to be inserted in 1 or 2, the second in 3 or 4, the third in 5 or 6. It will then be seen that with plugs in 2, 4, 6, the sensibility is 1; with plugs in 1, 4, 6, the sensibility is 0.1; with plugs in 2, 3, 6, it is 0.01; with plugs in 1, 3, 6, it is 0.001; with plugs in 2, 4, 5, it is 0.0001; with plugs in 1, 4, 5, it is 0.00001; with plugs in 2, 3, 5, it is 0.000001; with plugs in 1, 3, 5, it is 0.0000001. In all seven cases the joint resistance of galvanometer, shunts and series resistances between terminals II, II is equal to the resistance of the galvanometer alone.—*Elek. Zeit.*, Aug. 15.



FIGS. 1 AND 2.—GALVANOMETER SHUNT.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Cable Recorder.—JAULIN.—A description of an invention of Ader. The currents pass through a fine, long, copper wire of 0.02 mm. diameter, weighing 1 mg., placed vertically between the poles of a strong permanent magnet. The wire undergoes displacement at its center, on one side or the other, according to the direction of the current, its vertical position of rest being assured by the wire being under tension. This force can be regulated by a stretched silk thread acted upon by a weight. The wire is in a very narrow space between poles of not more than 0.5 mm. in breadth. The sensibility of this receiver is such that signals are produced by a current of one-third of a microampere. It is actuated by feebler currents and more quickly than the siphon recorder. A light shines through an orifice in one polar piece on to the middle of the wire, and through a slit in the other polar piece, the shadow of the wire being thrown upon sensitized paper. To emphasize this shadow, the wire has a little sheath of very light feather pith. A small motor actuates the tape. The inventor claims, by trial made on an Atlantic cable in 1896, that the transmission was 60 per cent faster than with the siphon recorder.—*Jour. Tel.*, June; abstracted in *Science Abstracts*, Aug.

REFERENCES.

Wireless Telegraphy.—RUHMER.—A brief illustrated account of some preliminary experiments made by him with the object of using the telephone as a receiver in wireless telegraphy. The experiments appear to have been successful.—*Phys. Zeit.*, Aug. 24.

Trans-African Telegraph.—An abstract from a recent report of the British South Africa Company. The company has carried the line up to the southern shore of Lake Tanganyka, and thence into German territory, the total length erected during the year being 325 miles. The great difficulties met with in the erection of the line are described.—*Eng'ing*, Aug. 30.

Telegraph Offices.—An illustrated description of the new Postal Telegraph offices in Cleveland and Denver.—*West. Elec.*, Sept. 7.

Munich.—The first part of a long illustrated description of the new telephone exchange at Munich, Germany.—Lond. *Elec.*, Aug. 20.

MISCELLANEOUS.

Arc Furnace for Making Glass.—BERMBACH.—A long paper, read before the Electro-Technical Society, of Cologne, on the use of arc furnaces for making aluminum, calcium carbide and glass. He gives the thermochemical data for the production of calcium carbide and aluminum and discusses the use of arc furnaces for this purpose. He thinks that the present crisis in the calcium carbide industry will cause many plants to undertake the making of glass. Several electric furnaces have been devised for this purpose, one of which is described as follows: The finely divided raw material (a mixture of silicium oxide, sodium carbonate and calcium oxide) drops from a funnel on an inclined plane, at the lower end of which the material is fused by means of two horizontal electric arcs. The fused glass which still contains some raw material then flows into a lower room where it is acted upon by another electric arc and then flows into a basin. Although fused glass is electrolyzed by direct current, it is possible to arrange the furnace in such a way that it can be operated with direct current.—*Elek. Zeit.*, Aug. 1.

Smelting of Iron Electrically.—SIMPSON.—A communication in which he takes exception to the estimate in an older article (Digest, May 25) in which the conclusion had been reached that an electrical process for smelting iron cannot be economical. He claims that this conclusion is wrong, as it is based upon the assumption that electrical power is worth anywhere from $20 upwards per horse-power-year. He says there are cases where electric power can be developed for $10 or less per horse-power-year, and claims that if iron mines and limestones are nearby steel could be produced cheaper by electric

smelting than by the old process, if a suitable electric furnace is used. In an editorial note it is said that while some figures might be changed in the original article, the former conclusion is correct that there is no possibility of an electric process competing successfully with the blast furnace.—*Eng. News,* Aug. 22. Another communication by Simpson, in which he maintains his position, in *Eng. News,* Sept. 5.

REFERENCES.

Magnetic and Electric Separators.—An article on some recent developments in magnetic and electric separators. The Wetherill magnetic separator is now being used successfully for treating the tailings of the dressing works at Broken Hill containing a mixture of galena, blende and garnet. At Lohmannsfeld, Germany, Wetherill apparatus are in successful use for treating an ore containing galena, siderite, blende and quartz. Edison's improved form of magnetic separator and Sutton and Steele's new form of electric separator are also noticed.—*The Elec. Chem. and Met.,* Aug.

Discharging Torpedoes by Electricity.—An illustrated description of the methods used on torpedo boats in directing the course of a torpedo and in firing the torpedo.—Lond. *Elec. Rev.,* Aug. 30.

Manufacturing Plant.—An illustrated description of the machine factory of the Gen. Elec. Co., of Berlin.—Lond. *Elec.,* Aug. 30.

Berlin Exposition.—RUHMER.—An illustrated description of the electrical apparatus exhibited at the present Berlin exhibition of fire protection and life-saving apparatus. The apparatus described are several systems of fire alarms, a telephone switchboard and several lamps, among them the Nernst lamp and the Regina arc lamp.—*Phys. Zeit.,* July 27, Aug. 3.

Glasgow Exhibition.—Brief illustrated descriptions of a Bellis-Peebles steam generating set, some direct-current motors exhibited by Peebles & Co., and an Evans electrically-driven ram pump.—Lond. *Elec.,* Aug. 30.

New Books.

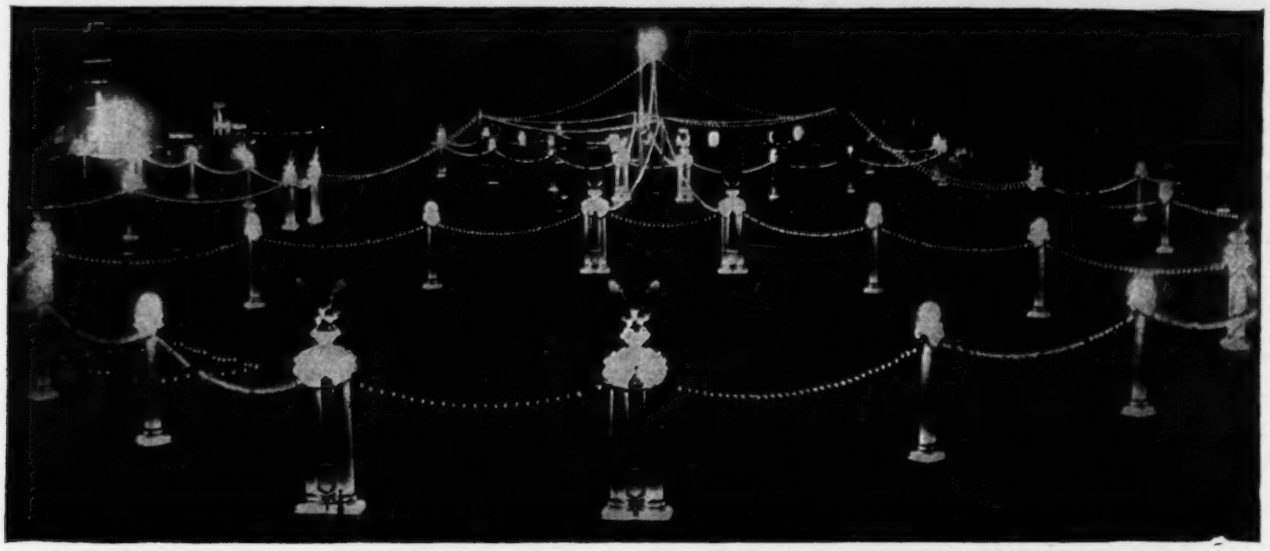
TUGMAN'S INDEX TO THE MANUFACTURERS OF THE UNITED STATES. Vol. I., Pennsylvania. Second Edition. The Tugman Company, Philadelphia, Pa. Cloth, 6 inches by 9 inches, pp. 648.

This index, which has been compiled for reference in the domestic and foreign trade, is without doubt the most complete and comprehensive work of its kind ever published. It lists nearly 10,000 lines of manufacture, and the completeness with which references are made is indicated by the fact that in the present large volume the names of only Pennsylvania firms are given. Other States will be taken up in later volumes. The name of each firm is followed by a number of symbols, indicating the firm's capital, whether or not it has a foreign office, and connections, and other matters of interest to foreign and domestic buyers.

This is probably the only work of its kind which affords the buyer abroad an opportunity to make an impartial selection of the firms who are in the best position to undertake the execution of large orders and who are accustomed to ship goods for export. The book has been placed on file with all United States consuls and boards of trade in foreign cities, and has also been supplied free to the leading commercial firms abroad. The lines of manufacture are given in English, French, German, Spanish and Portuguese, and are arranged alphabetically according to the English language. Indexes in the remaining tongues are added. A complete list of cable addresses is given and a list of the banks and lawyers in each town. The work has been compiled with great care and impartiality. The different firms were invited to submit a list of all the lines of manufacture in which they were engaged, and the entries were made accordingly and free of charge, the work depending entirely upon its advertisements and subscriptions for support. The present edition comprises 25,000 copies, which are being circulated widely and judiciously. The scope and completeness of the Index should make it eminently valuable in both the foreign and the domestic trade.

G. A. R. Electrical Display in Cleveland.

The electrical displays in Cleveland during the encampment of the Grand Army of the Republic last week were among the most attractive features of the event, and it was generally conceded by all the visitors and G. A. R. veterans that they were the finest ever arranged for a similar affair. The main group of decorations were those which adorned the Public Square in the center of the city. The four divisions of the Square were surrounded by wood and plaster pillars in imitation of marble. There were two large columns at each of the four corners of the four divisions, these being surmounted by huge eagles. The central columns were smaller and were topped with spheres. The smaller columns were ornamental, with about 100 incandescents each, while the larger ones had double that number. In the center of the Square, 50 ft. in the air, was suspended a huge sphere made up of 450 incandescents. Below this, in the form of a square, were suspended 24 emblems in various colored incandescents, representing the badges of the various G. A. R. corps. Streamers of incandescents ran from the center to the various corners, and when illuminated the whole effect was dazzling and beautiful. The plain incandescents on the columns and in the streamers numbered 1300 of 8 candle-power each, while the corps badges were made up of 1500 lamps of 5 candle-power each. The general plan and columns were designed by Hubbel & Benes, leading Cleveland architects, while the electrical work was done by the Dainz Electrical Company, under the general supervision of George S. Trippe, of the Cleveland Electrical Illuminating Company, which furnished the current. The wiring was all on the three-wire system, and all wires were concealed, those in the streamers being covered with evergreen festoons, while the column wires were all inside. All of the feed wires were also underground, the main feed wires coming from the Illuminating Company's conduits and entering the columns from below. There were 16 switching points, switchboards being placed in each of the main columns, each providing for the lights



G. A. R. ILLUMINATIONS, PUBLIC SQUARE, CLEVELAND, OHIO.

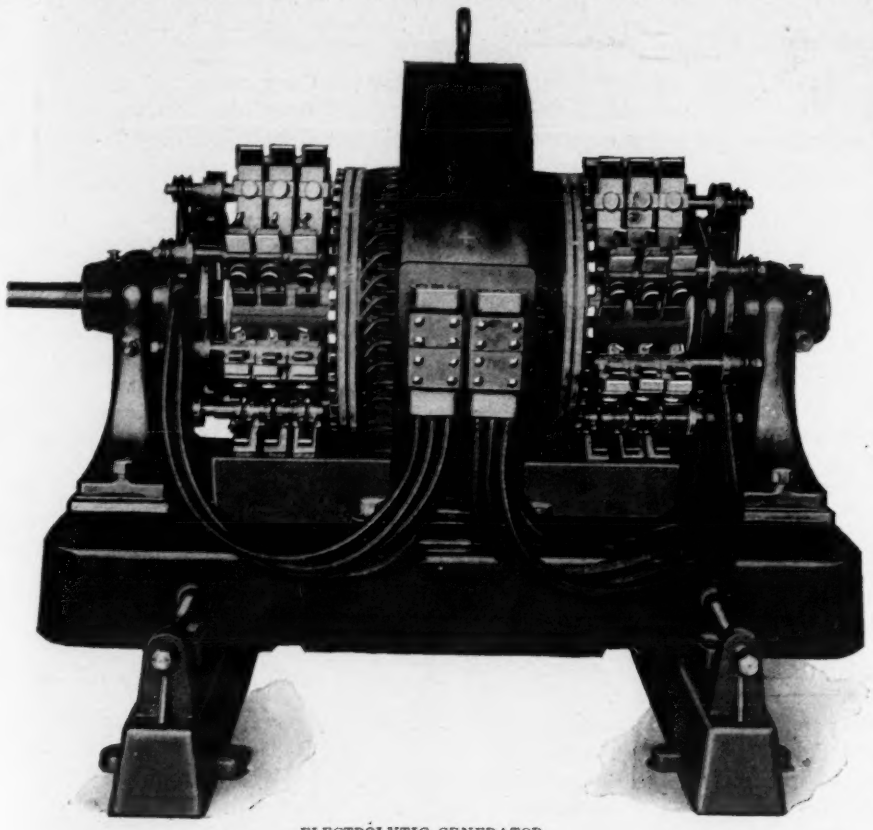
in its immediate vicinity. The entire decoration cost $15,000, the illuminations coming to about one-half that figure.

As soon as possible after the announcement of the death of President McKinley, the white columns were draped with black crepe. Several of the larger buildings surrounding the Public Square had special electrical displays for the occasion, while a number of large advertising signs added to the illumination at this point. The Society for Savings Building, a 10-story office building, presented a very pleasing effect. It was draped from top to bottom with red, white and blue incandescent streamers, while in the center of the building was a huge electrical revolving star. The May Company had incandescent streamers running to the top of its nine-story tower, while the fronts of both of its stores were handsomely decorated. All of the current in the downtown section was furnished by the Cleveland Electric Illuminating Company, and its machinery was severely taxed by the unusual loads. The Public Square decorations alone consumed over 400 kilowatts.

In installing the electrical work on the Public Square a peculiar accident occurred to P. L. McNerney, manager of the Dainz Electric Company, which did the wiring. The contract called for the completion of the work at 9 o'clock Saturday evening, Sept. 7. At 8.55 Mr. McNerney was engaged in screwing the last incandescent into the huge ball suspended above the center of the Square when a 50-ft. ladder broke beneath him. As it broke, he leaped and caught a trolley wire below him and then dropped to the ground. In dropping, however, he broke his arm. The lights were turned on exactly on time.

A New Electrolytic Generator.

The refinement or reduction of metals by electrolytic action is being carried on with very marked success in many of the mining communities throughout the world. The result has been a growing demand for an electric generator of relatively low voltage but enormous current output. The Holtzer-Cabot Electric Company, of Boston, Mass., has supplemented its line of platers with some larger generators designed more particularly for this class of work. The accompanying cut shows a generator of a capacity of 3000 amperes at an e. m. f. of from 4 to 8 volts. The machine shown is one of a pair recently built for the Imperial Ore Reduction Company, of Boston, to



ELECTROLYTIC GENERATOR.

be used for refining purposes at their copper mines at El Paso, Tex.

In designing machines of this nature two unusual problems present themselves. The first is a prevention of abnormal losses due to the heating effects of the current, or C^2R losses, as they are technically called, and the second is the commutation of the enormous quantity of current. In the machine represented, the first of these problems has been solved by careful attention to ventilation and generous allowances in point of copper and iron. The second difficulty has been overcome by the use of a double armature winding with two commutators and a special conformation of field.

The field ring is of cast iron, and the poles, eight in number, are of wrought iron, cast welded into the ring, making an excellent form of magnetic joint. The poles are fitted with a special form of shoe of cast iron selected on account of its low permeability. It is saturated at the normal induction of the field, and so helps to prevent the field flux from becoming distorted by cross magnetization in the armature.

The armature core is relatively of quite a large diameter, and is built up of thin disks of soft steel, painted on either side to break up eddy currents. It is mounted upon a spider, the laminations being clamped in a special manner by end plates, doing away with bolts running lengthways through the body of the core, thus preventing local currents and reducing magnetic hysteresis. The spider is provided with a threaded projection which holds the commutator in such a way as to leave an opening between the shaft and the commutator in front. Air ducts are provided in the core, and the air, being drawn into the body of the core and thrown out centrifugally through the ducts and winding serves to keep the armature cool, notwithstanding the great quantity of current flowing. The cylindrical form of winding is used, making the armature resistance low and permitting of the replacing of a damaged coil without much difficulty. The coils are of bar copper and entirely without joint except where they are soldered to the risers of the commutator.

The commutators are of massive construction. They are made up of hard rolled copper segments, soft mica being used for insulation, and are clamped by bolts in such a way as to prevent entirely shifting of the segments. The section of the copper segments was made unusually large, to take care of heat generated by the flow of the current and the friction of the brushes, and at the same time allow plenty of wear.

The brush holder is designed especially for carrying a heavy current. It is of the tangent type, and clamps the brush with a heavy thumb screw. There is a continuous metallic circuit from the portion of the holder carrying the brush to the part clamping the stud, so that no movable or sliding contacts are depended on to carry current.

These machines are separately excited at 110 volts, and owing to the special shape of the pole shoes are able to deliver any load from 0 to 3000 amperes without its being necessary to change the position of the brushes, the diameter of commutation remaining practically fixed for these ranges of load. They are designed to be belted and run at 450 r. p. m., the speed being made purposely low to do away with as much of the friction loss as possible, and also to prevent the brushes from cutting the commutator, a difficulty often encountered in high-speed machines of this type. The two halves of the armature deliver their outputs in parallel to the terminal blocks at the full voltage of the machine. These machines will be connected in such a way that they may work separately or in multiple, giving a total output of 6000 amperes at an e. m. f. ranging from 4 to 8 volts.

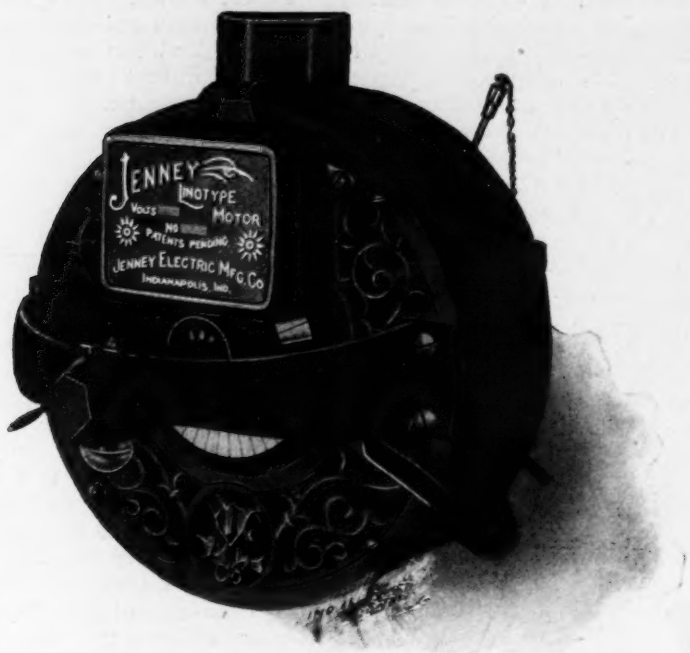
Jenney Linotype Motor.

The introduction of electricity into the printing office has opened up an inviting and profitable field for electric motors and appliances, and has resulted in a complete transformation of working conditions. The "Linotype" machine is one of the most important elements in the equipment of a newspaper or printing establishment, and consequently an economical and satisfactory drive for this machine is one of the living problems confronting the mechanical man of such a plant.

It has been the general practice to drive the linotypes from a counter-shaft, but this is open to all the objections of belting and shaft-

ing. One of the wasteful features in driving from a line-shaft is that the shaft with its driving motor, as well as the belts on loose pulleys, are in operation when but one or two linotypes are in service. When the machines are driven with individual motors they may be located in the most convenient place for light, or to economize in space, and can be moved without effecting the driving process. In order to reduce the disadvantages of driving by belt to a minimum, it has been the practice in many composing rooms to locate the linotypes on an elevated floor to provide room for driving a shaft under the said floor. The use of individual motors overcomes the necessity for such additional expense.

In order to meet the demand for an individual motor, the Jenney Electric Manufacturing Company, of Indianapolis, Ind., is making a 110 and 220-volt direct-current motor, to be mounted upon and geared to the linotype machine. The motor virtually becomes a part of the machine, making the combination a unit in itself, dependent upon nothing except the supply of current. The breaking or slippage of belts, hot boxes or other minor accidents which are liable to shut down the entire linotype plant are entirely avoided. Not only are the machines self-contained, but the regulation of speed is perfect, which is an important feature, as any irregularities in the speed of the linotype is very annoying to the operator. In order to allow for a fine adjustment of speed, there is an auxiliary field winding with five connections to a terminal board on top of the motor. By this



LINOTYPE MOTOR.

means a variation of 10 r. p. m. in the speed of the linotype machine is realized so that the operator can make the fine adjustment to suit conditions.

The motor, as a whole, is very compact and neat in appearance, and its efficiency is said to be all that could be desired, as the energy taken by the motor is only from 90 to 100 watts per hour, or less than that required by two 16-cp incandescent lamps.

The motor is multipolar and entirely enclosed, the field frame being cylindrical, with an ornamental, ventilated front head. The bearings are of phosphor-bronze and self-oiling. Two projecting lugs on the frame are drilled to receive bolts which hold the motor rigidly in place on the linotype frame. These bolts are the ones that hold the cap on main bearings of the machine, and in mounting the motor but one ⅜-inch tap is required.

As can be seen in the accompanying illustration, the gear and pinion are protected by a substantial brass guard. The regulating switch on top of the motor is also protected by a polished brass cap, while the brushes are likewise covered by an ornamental name plate. These features add materially both to the safety and to the appearance of the outfit.

Carbon brushes bear on the commutator with radial bars flush with the front head. The armature consists of form-wound coils placed on a toothed laminated core. The bronze pinion on the motor shaft and gear on the linotype have cut teeth. Every part of these motors is interchangeable and of the best material and workmanship, which accounts in part for the excellent service rendered.

The most prominent of the recent installations of Jenney linotype motors was made at the office of the *Chicago Tribune*, where 43 of these motors have been placed after a competitive test. These motors have also been placed in the offices of the *Indianapolis News, San Francisco Bulletin, Nashville News, Atlanta Constitution, Saginaw Post Zeitung, Dayton News,* and many other prominent newspaper and printing offices throughout the country.

Exhibits at Rochester Street Railway Convention.

At the Rochester meeting last week of the New York State Street Railway Association the local committee added one feature which has proved very popular at meetings of the National Association, but which has never been carried out to any great extent at State conventions. This was an exhibit of street railway supplies, which was most successfully carried out. The main floor of Fitzhugh Hall, the building in which the business sessions of the association were held, was used for this purpose. The hall was tastefully decorated with bunting, and in all some 40 exhibits were presented., in charge of F. D. Russell, of the Rochester Car Wheel Works, and to him and his fellow committee members great credit is due for the success of this portion of the convention.

THE SPEER CARBON COMPANY, of St. Mary's, Pa., displayed samples of its brushes, which are universally in successful use for street railway work.

GEORGE W. LORD, Philadelphia, maker of the famous Lord's boiler compounds, occupied a space among the exhibitors. Souvenir maps were given out.

THE FIDELITY & CASUALTY COMPANY, which insures against boiler and engine accidents, etc., occupied a booth in the convention hall, and distributed literature.

THE NEW PROCESS RAWHIDE COMPANY, Syracuse, N. Y., made a display of its pinions, which are used by over 200 electric railways, and known the world over.

THE PEERLESS RUBBER MANUFACTURING COMPANY, New York, occupied a large space with samples of its famous "Rainbow" packing and covering for pipes. A handsome pocketbook was given away to delegates.

THE CONSOLIDATED CAR HEATING COMPANY, of Albany, N. Y., had an exhibit, the most interesting feature of which was the special heater designed for the Manhattan Elevated, of New York, and for which the company has an order for over 21,000.

THE GOLD STREET CAR HEATING COMPANY had an exhibit in charge of Vice-President John E. Ward, a familiar personage at conventions. Their electric heater is well-known as one of the standard features of electric railway work, and a great many are in use in New York State alone.

THE MONARCH ENGINE STOP, made by the Monarch Manufacturing Company, of Waterbury, Conn., was shown by the Rochester Engineering & Supply Company, Jefferson Young, president. The same company had on display the New York asbestos air cell covering, the Cameron steam pump, the Merwath metallic gasket, and the Monitor water purifier.

E. C. STEARNS & CO., Syracuse, N. Y., had an operative exhibit of the Milloy automatic trolley catcher, which attracted much attention. The exhibit also contained the Green roller-bearing equalized tension, trolley base and the Milloy ball-bearing harp.

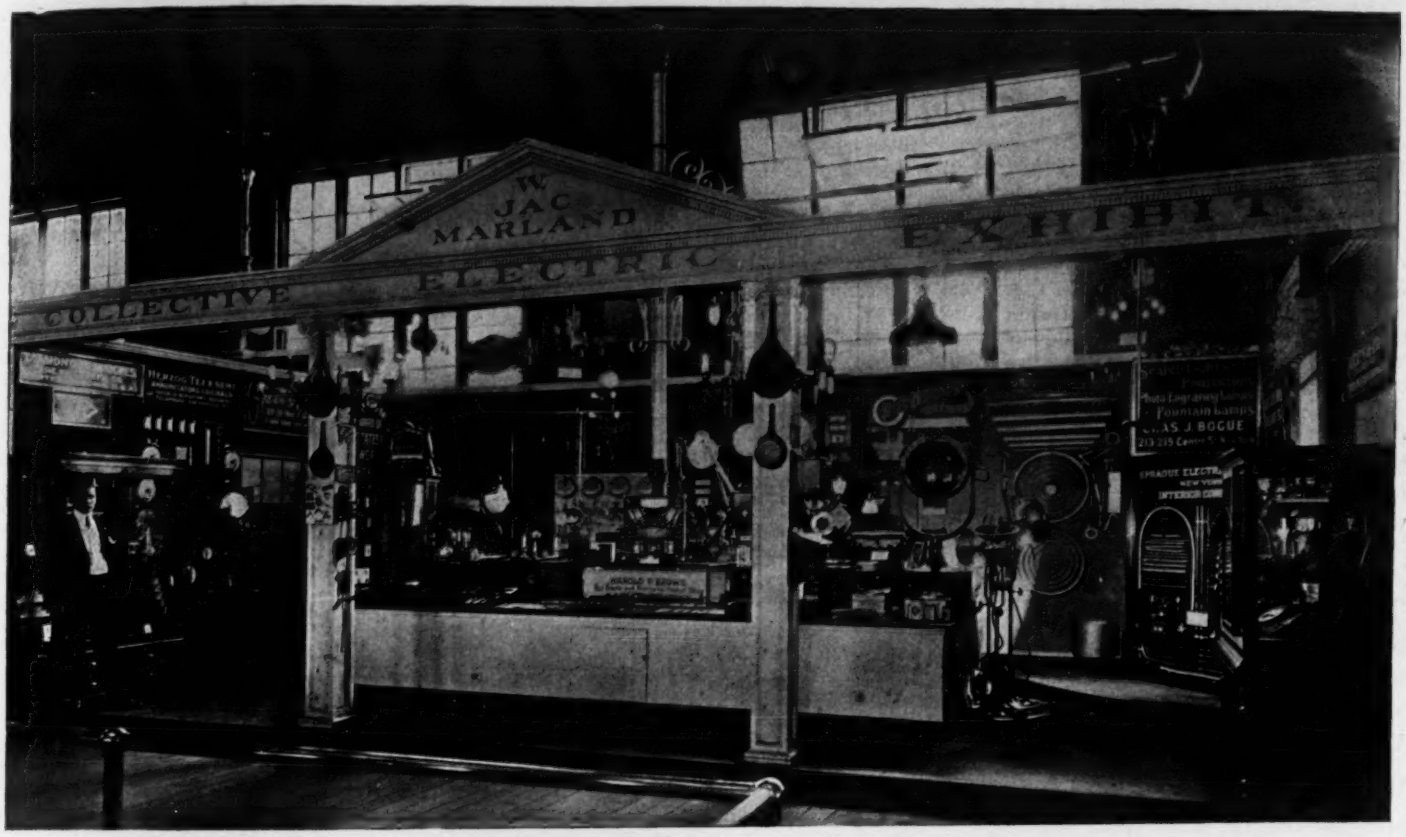
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, had some samples of its central station types of Chloride cells in the exhibition hall. The members of the New York Association have many kilowatt capacity of these batteries in use.

THE LORAIN STEEL COMPANY, Johnstown, Pa., is electrically welding some track for the Rochester Railway, and delegates were invited to inspect the work going on in Parcells Avenue. Besides this, H. F. A. Kleinschmidt, superintendent of the track welding department, made a small but extremely interesting exhibit of the joints and various parts used in making an electrically welded joint, and also of the electrically-brazed bond terminal, used for connecting around special work where the track is not welded. The welding of a rail-joint takes 15 minutes, total time, of which the current is on, two and one-half minutes, 250 amperes, at 500 volts.

Collective Electrical Exhibit, Pan-American Exposition.

W. Jac Marland, the electrical engineer, of 132 Nassau Street, New York, is the curator of a collective electrical exhibit section at the Pan-American Exposition. It is an exhibit which it has taken an immense amount of work to get together, and Mr. Marland certainly deserves the thanks of the Exposition for the energy he has displayed in preparing such an extensive collection. The exhibit is devoted to the products of 44 electrical manufacturers who did not care to go to the expense of making an individual exhibit and sending a representative. It is arranged in an interesting and attractive manner. The following are the exhibits and exhibitors:

C. J. Bogue, 213 Centre Street, New York, N. Y., searchlight, pilot house projector, photo-engraving lamps and fountain lamps; Harold P. Brown, 120 Liberty Street, New York, N. Y., plastic rail bond; H. P. Cameron Electric Manufacturing Company, Syracuse, New York, assembled commutators and separate parts; Chicago Fuse Wire & Manufacturing Company, Chicago, Ill., strip fuses, etc.; Crescent Manufacturing Company, Chicago, Ill., cord adjusters; H. C. Cushing, Jr., 39 Cortlandt Street, New York, N. Y., well-known book; Diamond Arc Lamp Company, Mt. Vernon, N. Y., alternating-current lamp and automatic switch; Dunn-Martin Electric Company, 75 Nassau Street, New York, N. Y., dome massage battery; Edison-Johnson Manufacturing Company, 50 Broadway, New York, N. Y., trolley harps and wheels; Electric Contract Company, 61 Elm Street, New York, N. Y., "Light of Asia" lamps and surgical and dental sets; Ericsson Telephone Company, 296 Broadway, New York, N. Y., wall telephones, inter-communicating telephones, desk sets, switchboards, etc.; Eschwei Electric Company, 49 Centre Street, New York, N. Y., direct-current lamps; P. H. Gilbert, Scranton, Pa., up-to-date trolley pole and ice-cleaning wheel; Hart Manufacturing Company, Hartford, Conn., well-known "Diamond H" switches; Hazazer Telephone Company, 8 Dover Street, New York, N. Y., switchless inter-communicating telephones; Herzog Teleseme Company, 51 West Twenty-fourth Street, New York, N. Y., up-and-down system of elevator service, telephone annunciator, portable annunciator, etc.; Hydra Double Battery Company, 32 Broadway, New York, N. Y.; Indelectric Manufacturing Company, 131 West Thirty-first Street, New York, portable medical battery; Jaeker's well-known soldering salts and samples of work done with same; Jenkins Brothers, New York, N. Y., magnetic lamp holder; J. Jones & Son, 64 Cortlandt Street, New York, N. Y., electrical supplies; H. Krantz, Boerum Place and State Street, Brooklyn, N. Y., specially constructed switchboard; D. J. Mahler, Providence, R. I., electrical apparatus for home treatment; Montauk Fire Detecting Wire Company, 100 Broadway, New York, N. Y., demonstration of their well-known special wire products; McLeod, Ward & Co., 27 Thames Street, New York, N. Y., full line of desk shades; Oak Motor Company, 97 Reade Street, New York, N. Y.; Parsell & Weed, 131 West Thirty-first Street, New York, N. Y., Franklin model dynamo operated by motor; The Phelps Company, Detroit, Mich., well-known "Hylo" lamp and special lamp for photographers; Prentiss Clock Improvement Company, 49 Dey Street, New York, N. Y., "frying-pan" clocks, calendar clocks, time switches, etc.; Pyle National Electric Headlight Company, Chicago, Ill., locomotive headlight; Queen & Co., 1010 Chestnut Street, Philadelphia, Pa., X-ray apparatus, photometers, testing sets, switchboard instruments, etc.; William Roche, 42 Vesey Street, New York, N. Y., different sizes of the "New Standard" dry battery and new system of gas and gasoline engine ignition; Sage Brothers, 120 Liberty Street, New York, N. Y., ohmmeters; Railway Equipment & Supply Company, Cincinnati, Ohio, specially constructed poles; Socket Extension Tap Company, Boston, Mass., socket extension taps; Speer Carbon Company, St. Mary's, Pa., arc lamp carbons, telephone carbons and the well-known self-lubricating carbons; Sprague Electric Company, full line of interior conduits and appliances; Standard Electric Welding Company, Cleveland, O., electric welded samples; F. H. Stewart & Co., 35 North Seventh Street, Philadelphia, Pa.; Stow Manufacturing Company, Binghamton, N. Y., multi-speed electric motor and Stow flexible shaft; Emile J. Tardie, 221 Sixth Avenue, New York, N. Y., portable ornamental electric clock stands, portable electric candles, etc.; Thomson Electric Welding Company, Lynn, Mass., sample board of electric welded materials; Utica Drop Forge & Tool Company, Utica, N. Y., electricians' drop forges, tools, etc.; W. C. Vosburg Manufacturing Company, 296 State Street, Brooklyn, N. Y., extensive display of fixtures, brackets., etc.



COLLECTIVE ELECTRICAL EXHIBIT, ELECTRICITY BUILDING, PAN-AMERICAN.

An electrical engineer of Mr. Marland's experience is able to present and arrange an exhibit to best advantage to be attractive to both the engineer and general public. As far as possible one device works upon another.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call was nominal, closing at 6 per cent. Time money was little called for, closing at 5@5½ per cent for all maturities. Mercantile paper closed at 5@5½ per cent for 60 to 90 days' indorsements, and choice four to six months' single names, 6 per cent for others. The same interests which supported prices in the stock market early in the week, after the news of the shooting of the President, again had large buying orders in force, and prevented the break from becoming serious. The unfavorable turn on Friday of the President's condition, however, caused selling and heavy declines in stock values. On Saturday the Exchange was closed out of respect to the memory of the deceased President. Electric and traction securities closed the week with net losses, as a result of the general drop in prices after the receipt of the news of the alarming condition of the President. These losses, however, were not so marked as many in the railway list. Brooklyn Rapid Transit on Friday reached 64¼, but dropped to 61½, the closing price being 62¾. Metropolitan Street Railway on the same day reached 162, fell to 159, and closed at 160½, the highest quotation for the week being 166. General Electric fluctuated between 251 and 264½ during the course of the week. Western Union kept comparatively steady at prices ranging between 90½—the closing price of the week—and 92¾. The sales and net losses of the leading traction and electric stocks as recorded at the close of the week were as follows: Brooklyn Rapid Transit, 60,250, net loss 2⅞; Metropolitan Street Railway, 12,410, net loss 2¼; General Electric, 3700, net loss 1; Western Union, 9210, loss ¾. On the Boston Exchange on Friday there was a slump of 24 points in Boston Elevated stock on reports of a heavy land damage suit against the company and efforts to stop the running of trains during certain hours of the night on account of noise. It is stated that suits aggregating $1,000,000 have already been filed against the company. Following are the closing quotations of Tuesday, Sept. 17, compared with those at the close of the previous week:

NEW YORK.

	Sept. 10	Sept. 17.		Sept. 10	Sept. 17.
American Tel. & Cable...	—	99	General Carriage.....	¾	¾
American Dist. Tel.....	—	—	Hudson River Tel.....	120	120
Brooklyn Rapid Transit..	68½	65⅜	Illinois Elec. Veh. Trans.	—	—
Commercial Cable.....	—	—	Metropolitan Street Ry..	165⅞	162½
Electric Boat.....	20	18	N. E. Elec. Veh. Tran...	—	—
Electric Boat pfd.....	47	45	N. Y. Elec. Veh. Tran...	10	10½
Electric Lead Reduc'n...	2	2	N. Y. & N. J. Tel.....	168	168
Electric Vehicle.....	5½	5	Tel. & Tel. Co. of Am...	5	5
Electric Vehicle pfd.....	8	9	Western Union Tel.....	92⅝	92⅞
General Electric.....	264	260¾			

BOSTON.

	Sept. 10	Sept. 17.		Sept. 10	Sept. 17.
Am. Tel. & Tel.....	164	164	Mexican Telephone.....	2⅛	2¾
Cumberland Telephone...	—	—	New England Telephone.	—	—
Boston Electric Light...	250	—	Westinghouse Elec.....	—	—
Erie Telephone.....	35	34	Westinghouse Elec. pfd..	—	—
General Electric pfd.....	—	—			

PHILADELPHIA.

	Sept. 10	Sept. 17.		Sept. 10	Sept. 17.
American Railways.....	40½	40	Phila. Traction.....	97⅝	95⅝
Electric Storage Battery.	70	72*	Philadelphia Electric....	5½	5½
Elec. Storage Batt'y pfd.	70	72*	Pa. Electric Vehicle.....	½	½
Elec. Co. of America....	7⅛	7⅛	Pa. Elec. Veh. pfd.....	½	½

CHICAGO.

	Sept. 10	Sept. 17.		Sept. 10	Sept. 17.
Central Union Telephone.	—	—	National Carbon pfd....	84¼	84¼
Chicago Edison.....	165	166	Northwest Elev. com....	39	41*
Chicago City Ry.....	206	203	Union Traction.....	17⅛	16½
Chicago Telep. Co.....	275	275*	Union Traction pfd.....	58	58
National Carbon.....	18	17¾			

*Asked.

NEW YORK METROPOLITAN.—In his evidence before Referee Earl in the franchise tax hearing at Albany, President Vreeland, of the Metropolitan Street Railway, said the company had put in electrical power at a cost of $6,000,000, which necessitated a loss of $6,000,000 in equipment. When he took charge of the roads there were only four transfer points, and at present there are 300, although there is no legal obligation on the company to grant transfers. In the present year Mr. Vreeland says the company has carried 395,000,000 cash passengers, 50 per cent of whom took transfers, so that the average fare received was 2½ cents per passenger. As an instance of the result of electric operation, Mr. Vreeland said that on the Madison Avenue line the gross receipts in the days of horse car service were $760,000, and the operating expenses 70 per cent. Under the electric system, gross receipts increased to $2,000,000 and the operating expenses decreased to 35 per cent. Mr. Vreeland pointed out that the company operates 16 systems of railroads, many of which would not pay expenses if operated separately. He sprung a sensation by saying that the question of abandoning leases and returning to the past chaotic system depended upon the action in reference to the franchise tax, at least in regard to certain lines. The company, he said, has over 90 miles of road still operated by horse power, which do not pay expenses and which will cost $150,000 a mile to convert to electric lines. Mr. Vreeland said that the wiping out of the staff of the Third Avenue system saved $100,000 a year, and that the cost of electric power to the Third Avenue Company was 6 cents a mile, whereas to the Metropolitan Company it was only 1½ cents a mile.

AMERICAN TELEPHONE.—An important conference of leading Eastern telephone people was held last week with President Fish at the Boston offices of the American Telephone & Telegraph Company. Among the conferees were President Cutler and General Manager Bethell, of the New York Telephone Company; President Mitchell and General Manager Spencer, of the Philadelphia Company; General Sherwin and other officials of the New England Company, and Vice-President E. J. Hall, of the American Telephone & Telegraph Company. It is understood that the conference was in relation to a readjustment of telephone rates. It was stated, however, that the meeting was a matter of detail in connection with the business of the company in which the public has no interest. One result has become known, however, which is of special importance. Mr. Bethell, who has made such a brilliant success of his work in New York, has been confided, it is understood, with the management of the Chesapeake & Potomac Company. He has been spending this week in Washington familiarizing himself with the situation there. The arrangement is somewhat analogous to that under which Mr. J. I. Sabin is directing telephone affairs, both in Chicago and the Middle States and on the Pacific Coast, so that Mr. Bethell will not be lost by New York. This incipient "districting" of the Bell telephone system is being watched with the deepest interest. Mr. Bethell was once a law student and Government clerk at the National capital.

DIVIDENDS.—The United Traction & Electric Company (of New Jersey) has declared the usual quarterly dividend of 1 per cent, payable Oct. 1. General Electric directors declared the regular quarterly dividend of 2 per cent on the common stock. The second installment of 1 per cent of the 4 per cent dividend on International Steam Pump common stock will be paid Oct. 1. The directors of the Otis Elevator Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable Oct. 15. The regular dividend of $2 per share has been declared on the Philadelphia Traction Company stock, payable Oct. 1. The executive committee of the Western Union Telegraph Company has recommended the declaration of the usual quarterly dividend of 1¼ per cent. In accordance with the provisions of the lease of the West End Street Railway Company to the Boston Elevated Railway Company a dividend rental of $1.75 per share will be paid to holders of record of West End common stock on Oct. 1. Union Switch & Signal Company declared a dividend of 2 per cent on preferred stock and 1 per cent on common.

EMPLOYMENT FOR RECEIVERS.—The following shrewd and cynical suggestion is put forward by the *Railway Age:* "A receiver has been appointed for a suburban electric railway at Buffalo—which suggests the thought that, while the prospects for the receivership business on steam roads at present are poor, there is a new and rapidly growing field for bankruptcy in connection with ambitious electrical railway projects. The long-distance transportaion of passengers and freight involves vastly greater expense in the way of road equipment, terminals, stations, employes, liability for loss and damage, and many other things, than the running of trolley cars for local passenger business, and experimenters in this new field are liable to be wrecked by unprofitably low rates. Transportation cannot long be furnished at less than cost, even by trolley roads." And yet yellow journals of the kind that helped kill Mr. McKinley are howling for three-cent fares and "municipal" roads run for nothing.

ELECTRIC STORAGE BATERY.—An officer of the Electric Storage Battery Company is authority for the statement that the business for the first half of the current year has exceeded the same period of 1900, and the dividends are being more than earned. Dividends were commenced last December, and the next quarterly dividend will be payable about Oct. 1. Action on it will be taken at the board meeting which will be called about Sept. 18. It is expected that the usual 1¼ per cent will be declared.

WESTERN UNION FINANCES.—The directors of the Western Union Telegraph Company have declared the usual quarterly dividend of 1¼ per cent, payable Oct. 15. The company issues the following statement for the quarter ending Sept. 30, the figures for the current year being partly estimated and those for 1900 actual:

	1901 (*Estimated*).	1900 (*Actual*).		Changes.
Net revenue	$1,850,000	$1,600,925	Inc.	$249,075
Bond int.	239,040	223,945	Inc.	15,095
Balance	$1,610,960	$1,376,980	Inc.	$233,980
Dividends	1,217,005	1,217,000	Inc.	5
Surplus	$393,955	$159,980	Inc.	$233,975
Prev. sur.	9,319,285	8,298,224	Inc.	1,021,061
Total sur.	$9,713,240	$8,458,204	Inc.	$1,255,036

The actual returns for the quarter ending June 30 were: Net revenues, $1,762,435; bond interest, $239,040; balance, $1,523,395; dividends, $1,217,005; surplus, $306,390; previous surplus. $9,012,894; total surplus, June 30, $9,319,284.

WASHINGTON TROLLEYS.—A committee, consisting of Geo. W. Young, president of the United States Mortgage & Trust Company, of this city, chairman; John Crosby Brown, James Timpson, William H. Hollister and Gardiner M. Lane, has prepared a plan of reorganization of the Washington Traction Company, which provides for the foreclosure of the first collateral trust mortgage and the transfer of the property either to a new company or to the Washington & Great Falls Electric Railway Company, whose name under the act of Congress passed June 5, 1900, shall be changed to the Washington Street Railways Company, or otherwise modified. The successor company will authorize the issue of mortgage bonds and capital stock as follows: Fifty-year mortgage 4 per cent gold bonds, interest payable each six months, $17,500,000; preferred stock, 5 per cent, cumulative after June 1, 1904, $8,500,000; common stock, $6,500,000.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph instrument statement for month ended Aug. 20, shows:

	1901.	1900.		Changes.
Gross output	81,144	45,555	Inc.	35,589
Returned	42,997	27,208	Inc.	15,789
Net output	38,147	18,347	Inc.	19,800
Since Dec. 20:				
Gross output	607,593	457,164	Inc.	150,429
Returned	267,807	189,961	Inc.	77,846
Net output	339,786	267,203	Inc.	72,583
Total outstanding	2,292,602	1,847,708	Inc.	444,898

THE EMERSON ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., filed notice Sept. 6 of the increase of its capital stock from $75,000 to $300,000. The assets are named as $331,000 and the liabilities $22,000.

Commercial Intelligence.

THE WEEK IN TRADE.—A satisfactory business was done in all branches of trade, while such measures of trade development as bank clearings and railway earnings all point to a steady maintenance, and even enlargement of the expansion already noted in fall trade and in leading industries. Industrially, the situation is being helped by the practical dwindling away of the steel strike. The features of the week were the continued good reports as to trade and collections received from the West, Northwest, Southwest and some parts of the South, all reflected in good advices in turn from the leading Eastern centers of trade and manufacture. The total earnings of 96 roads in August aggregated $67,889,217, a gain of $7,938,919, or 13.2 per cent over last year. The smallest gain, that reported by the Southern roads, is nearly 10 per cent. The business failures for the week, as reported by *Bradstreet's*, numbered 182, as compared with 169 the week previous and 167 the same week last year. In the copper market there is no change. Some of the Lake mines, it is said, sold to home consumers for delivery up to the end of the year at 16½ cents. Lake is quoted at 16½ cents and electrolytic and standard brands of casting 16¼ cents up to 16⅜ cents.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has recently closed several contracts for the installation of batteries of "Chloride Accumulators" in lighting and railway power houses. Among these are noted the installation of the St. Paul (Minn.) Gas Light Company, which is to consist of 166 elements having a capacity at normal rate of discharge of about 1300 kilowatt-hours, but capable of a much higher discharge rate for the peak work for which it is principally required. The power for the Gas Light Company is obtained from a water-power plant 27 miles from the city, from which place it is transferred at 25,000 volts to a rotary sub-station in St. Paul, and thence distributed at 120 volts on each side of the three-wire system. The battery located at the St. Paul station is for the purpose of obtaining additional capacity, increasing the reliability of service, and as a reserve in any emergency that may arise. The Laclede Power Company, of St. Louis is installing a Chloride battery consisting of 336 elements having a discharge rate for one hour of 500 amperes on each side of the three-wire system. The Minneola, Hempstead & Freeport Traction Company has contracted for the installation of a battery consisting of 270 elements, having a discharge rate of 120 amperes, for regulating the rapid fluctuations on the railway circuit. The containing jars are of sufficient size to allow of 50 per cent increase in capacity.

RAPID TRANSIT CONTRACTS.—Last week contracts of a heavy nature were made by the Subway Construction Company, who are constructing and will equip the New York Rapid Transit Railroad. One order for the engines was given to the Allis-Chalmers Company, and provides for eight units each of 7500 horse-power at best efficiency, and developing a maximum of 11,000 horse-power, 75 r. p. m. at 175 to 200 lbs. steam pressure. Each engine will consist of two combined component engines operating on one shaft, and will have a vertical low-pressure cylinder and a horizontal high-pressure cylinder, both cylinders connecting to one crank pin. The other order was awarded to the Babcock & Wilcox Company for 48 horizontal water tube boilers, in 24 batteries, each boiler of 1200 horse-power (15 lbs. basis), of the regular B. & W\ type, with slight alterations, to allow for adaptation to superheating. Each engine is to be direct connected to a generator, rated at 5000 kilowatts, of the revolving field flywheel alternator type. Specifications will soon be prepared for the stokers, condensers, pumps, etc., and will be in shape in November. The generator contracts will soon be due. The size of the units is remarkable.

WATERTOWN ENGINE COMPANY.—The strike at the shops of the Watertown Engine Company has terminated in the complete surrender of the men, who have returned to work at the old wages and the old orders. For the 14 weeks during which the strike lasted the Engine Company entered no new orders, employing the small force of non-union men entirely in finishing up orders previously entered. With the resumption, orders have come in with gratifying promptness, and its shops are again full of work. The company has just completed an installation of 1000 horse-power for the Oxford Paper Company at Rumford Falls, Me., and is now at work on an 800-hp plant for the Remington-Martin Company, at Norfolk; a 400 horse-power for the Eastern Lumber Company, of Tonawanda; 300 horse-power for the Raymondville Paper Company; 400-hp vertical cross compound high-speed engine for the Mare Island Navy Yard; 250-hp horizontal tandem compound for the Ohio State University and a considerable number of other smaller high-speed engines.

THE TOOLS BEHIND THE GUNS.—As an illustration of the effective manner in which the piping times of peace heal the wounds of war, the Spanish Government has placed an order with the Niles Tool Works Company for engine lathes to be used in the Government gun works for the manufacture of large ordnance. This also goes to show that our good friends, the Spaniards, have not failed to learn the lesson which the war so palpably contained. They realize that their European guns were inferior to those in use in the American ships, and they believe that one of the ways in which to obtain as good guns as the Americans have is to use American machinery in the manufacture of them. They might go a step further and have American brains control the operation of the machinery. At any rate, the order demonstrates the fact that the Spaniard is willing to pocket his prejudice and learn a practical lesson, and the man who is willing to learn need not worry as to his future.

PLANT FOR ARMOUR ELEVATOR.—Armour & Co., Chicago, are installing in their new elevator at New Orleans, La., an electric plant, consisting of 125 and 60-hp engines, built by the Ball Engine Company, Erie, Pa., direct connected to Triumph Electric Company generators. The Triumph Electric Company, Cincinnati, Ohio, is obliged to run its factory with its full complement of men 24 hours a day in order to take care of the business which it has on hand.

NEW YORK ELEVATOR APARTMENTS.—Manhattan Island has about 450 apartment houses with elevators, all being six or more stories. Many of these elevators are electric, and the number tends to increase as additional circuits go in, making a good source of income in the residential districts, where electric light is also continuously gaining.

CATALOGUES of electrical apparatus are requested by Wilkinson & Richardson, electrical contractors, Middletown, N. Y.

THE STERLING ELECTRICAL MANUFACTURING COMPANY, of Warren, Ohio, has just completed one of the most modern and up-to-date lamp factories in the United States, with equipment of the very best. Its main building is 60 by 80, three stories, and is equipped for an output of 1,000,000 lamps per year. It will manufacture all kinds of incandescent lamps, but lay stress on its "Sterling Special," made by a process strictly its own, with a double spiral filament so constructed as to give an equal radiation of light from all points around the bulb and from the bottom of the bulb. The filament of this lamp is thoroughly and firmly anchored. The company has advance orders for many thousands of them, some of which are to be used in Government work. It will be able to fill orders any time after Oct. 1. The factory management will be in charge of Glenn C. Webster, who for 10 years past has been active in the management of incandescent lamp factories, and has been general superintendent of the Warren Electric & Specialty Company, the Economy Electric Company, of Warren, and the Colonial Electric Company, of Ravenna. The city of Warren is one of the finest shipping points in the Middle States, as it has a daily express train service of about 40 trains. The Adams, Wells Fargo and United States Express companies have offices in Warren, operating over three trunk line divisions, viz., Pennsylvania, Erie and Baltimore & Ohio. The officials of the company are: W. A. Smith, president; C. G. Denison, vice-president; Glenn C. Webster, secretary and superintendent; William Coale, treasurer.

IMPORTANT ELECTRICAL EQUIPMENT CONTRACT PENDING.—Some further data is to hand regarding the Pacific Coast Portland Cement Company's projected plant to be erected at Vancouver, B. C. The works, which will be operated entirely by electricity, were at first intended to have a capacity for turning out 500,000 barrels of cement per annum. In view of the fact, however, that besides the plant being the only one engaged in the manufacture of Portland cement on the Pacific Coast, the promoters have just made arrangements with a well-known export house which guarantees to take yearly 500,000 barrels of cement for the China and other Far Eastern trades, it is anticipated that the initially planned factory will be largely increased. The electrical portion of the contract—as originally decided upon—will mean an expenditure of about $90,000. Should the suggestion of a larger plant be carried out, of course, these figures will have to be increased. In addition to the electrical machinery all the other equipments to be installed in the Vancouver plant will be purchased in the United States. Mr. J. Keith Fisher, who is primarily interested in the enterprise, has just sailed for Europe with a view to perfecting some financial details relating to the project. On his return, which will be inside of six weeks, it is expected that the contracts for the equipment of the factory will be determined on. The New York offices are at 66 Broadway.

STRIKES AND INVENTION.—It is stated that one marked effect of the machinists' strike was noticed in the factory of the American Graphophone Company, at Bridgeport, Conn. As a result of the disaffection among the workmen this company found it necessary to close one of its most important departments. Operations were suspended for a fortnight, but during that time it was once more demonstrated that necessity is the parent of invention, and special machinery, designed by ingenious men, was quickly supplied, through the use of which one man was enabled to do the work of three, then four and finally nine machinists. The result of this was that the special machinery, evolved under stress of circumstances, and which might never have been forthcoming under ordinary conditions, was operating so effectively long before the strike was over, that the need of many of the former employes had ceased to exist in that department.

LARGE ORDER FROM PARAGUAY.—Hon. J. N. Ruffin, United States Consul at Asuncion, Paraguay, who is spending his leave of absence in the United States, has succeeded through his unceasing and patriotic efforts in bringing with him many important orders from the Paraguayan government. Among others a large order has been placed with the American Steel & Wire Company for steel wire, and the Western Electric Company for telegraphic appliances to the amount of $7,000 for a new telegraphic line from Asuncion to several important forts on the Bolivian frontier. The Paraguayan Board of Education has also ordered several hundred school desks from a prominent Ohio manufacturer for the sum of $3,000. The above orders have been financed by the Export Shipping Company, of New York, who act as the disbursing agents for the Paraguayan government.

CRANE COMPANY.—On account of the fact that the space devoted to floor molding has been entirely inadequate to the demands of the business, and in order to relieve the works at Canal and Judd Streets, Chicago, of some of the heavy work, Crane Company has this summer erected at its works at Jefferson, Van Buren and Desplaines Streets, a foundry which is to be devoted exclusively to very heavy work, i. e., flanged fittings and large valves. It is a one-story brick building with a slate roof, and is equipped with two cupolas, an electric traveling crane, and every other modern convenience. This new foundry will increase Crane Company's capacity for very heavy work about 50 per cent, and it is expected to be in operation in about 30 days.

EXPORT TRADE GAINS.—The exports of the United States for the eight months ending Aug. 31 show an increase of $22,668,298 over those for the same period last year, and the aggregate for the 12 months ended the same date for the first time passed the billion and a half mark. The balance of trade in favor of the United States shows an increase of $106,607,166 for the year, aggregating $656,931,876. For the month of August the imports of merchandise were valued at $72,906,840, being an increase of $11,086,352 over those for the same month last year, and the exports aggregated $107,426,417, an increase of $3,850,452. The imports for the eight months increased $14,531,646, while for the 12 months a net decrease of $4,994,456 is shown.

WATER POWER DEVELOPMENT IN CHILI.—Mr. Santiago Sotomayor, of Chili, South America, is in Ottawa, Ont., on railway business, and is representing the Chilian Government in connection with certain electrical enterprises in that country. Mr. Sotomayor states that he has visited Ottawa in order to examine into the utilization of water power for electrical purposes. In Chili, all of the electric railway power is developed by steam, but there is abundance of water power available, and the use that is made of such power in Canada, when reported upon by Mr. Sotomayor, may lead to a change in the Chilian methods in this respect. Mr. Sotomayor is a railway contractor, and his general manager is Mr. Charles Symmes, formerly of Aylmer, Que.

CHARLES E. DUSTIN COMPANY is the name of a new engineering and electrical concern just started at the Bowling Green Building, 11 Broadway, New York City. It will make a special feature of its business the purchase and sale of all kinds of electrical apparatus, boilers, engines, etc., and will also engage in construction work. The president and general manager, Mr. C. E. Dustin, has long been favorably known in the electric lighting and supply field, and the company has retained Mr. W. S. Barstow, formerly general manager of the Brooklyn Edison Company, as its active consulting engineer. The capital of the new company is $250,000. A large amount of business already opens up before the concern.

THE WATSON-STILLMAN COMPANY, of New York, has recently built 16 presses for shipment to Germany, in addition to which they have lately received an order for 14 hydraulic presses to go into the Manchester plant of the British Westinghouse Company. These are intended for various purposes, and although it was understood originally that the presses would be ordered in England, the conditions were such that the Watson-Stillman Company finally obtained it. This company reports that it is extremely busy with both domestic and foreign trade.

TRADE WITH JAPAN.—Mr. E. C. Bellows, United States Consul General at Yokohama, writes that this country stands first in Japan in imports of rails, electric light wire and telegraph wire, and leads in electric lighting and mining machinery. Belgium leads in telephones. He adds: "Electric street cars are in use in Kyoto, and are constantly filled; are, in fact, so well patronized by the working classes that the wealthier people still employ the jinrikisha to avoid the crowding. An electric car line has been projected at Tokyo and at Yokohama, but work has not yet begun."

NEBRASKA POWER.—Mr. J. P. Morgan and others are said to be interested in a project to spend several millions in developing power on the Loup River, near Fremont, for transmission to Omaha, 28 miles away. The amount to be spent may, it is asserted, reach $20,000,000, and some 30,000 horse-power is named. This is certainly a "large" project. Mr. F. A. Nash, president of the New Omaha Thomson-Houston Company, Omaha, is among those interested.

BELTING ORDERS.—The veteran Colonel J. H. Shay, of the Chicago Belting Company, 76 South Canal Street, Chicago, while in New York this week, reported securing large orders for belt from the Harrisburg Light, Heat & Power Company, and from J. P. McQuaide for the new factory of the National Conduit & Cable Company at Hastings-on-the-Hudson. He has also received some other good orders from electrical concerns. The Harrisburg belts run up to 40 and 54 inches in width.

TELEPHONE APPARATUS WANTED.—The Home Telephone Company, of Jamestown, N. Y., is to begin immediately the construction of an exchange of 1500 telephones. It is now in the market for the entire equipment necessary. The work will include several miles of underground construction. J. Vautrot is president, P. H. Hoyt vice-president, C. B. Selby secretary and M. M. Skiff treasurer. The capital is $200,000.

COPPER CONSUMPTION.—Mr. H. L. Casey, lately a salesman for the United States Selling Company, alleges that the concern holds 135,000,000 lbs. of copper, or about 20 per cent of the American production, and is stacking it up at the rate of 20,000,000 lbs. a month because of decreased consumption. We doubt extremely whether consumption has decreased. It certainly has not in the home electrical field. Mr. Lewisohn says Casey is "'way off."

General News.

THE TELEPHONE.

TEXARCANA, ARK.—S. F. Richardson has a franchise for the installation of a telephone system.

CARROLTON, GA.—Lewis K. Smith, manager of the Gainesboro Telephone Company, is looking after the building of lines to Hiram and Dallas, Ga., from Powder Springs, which will be connected soon with the Bell system.

DIXON, ILL.—The Lee County Telephone Company has petitioned for a franchise.

FREEPORT, ILL.—A franchise has been granted to the Independent Telephone Company.

BLOOMINGTON, ILL.—The Farm & City Telephone Company has accepted the Clinton franchise.

MONARCH, ILL.—Jacob Smith, of this place, is putting in an independent telephone line at Belleflower.

SPRING VALLEY, ILL.—The Bureau County Independent Telephone Company is now building a line between Princeton and Bureau Junction.

PEARL CITY, ILL.—Dr. Clay has organized an independent telephone company and has been granted a franchise in the village of West Freeport.

ROCKFORD, ILL.—Bills & Wortham have let the contract for the construction of the new telephone system at Rockford to the Jones & Winter Company, of Chicago, for the sum of $133,610.

JERSEYVILLE, ILL.—The Calhoun County Telephone Company has increased its capital stock from $5,000 to $15,000. The company may consolidate with the Pike County Telephone Company.

KEYESPORT, ILL.—The City Council has granted a franchise to the Southern Union Telephone Company to construct a line. Work will begin at once, running wires to Carlyle to connect with the Bell system.

WOODSTOCK, ILL.—The Woodstock Exchange & Telephone Company, of Woodstock, has been incorporated, capital $20,000, to operate heat, light, cold storage, and telephone system. Incorporators: C. H. Donnelly, G. W. Field, D. R. Joslyn.

TUSCOLA, ILL.—The farmers living in the northern part of this township and the northwestern part of Camargo Township are organizing a mutual benefit telephone company and propose to connect Villa Grove, West Ridge and Hayes with this city.

ALTON, ILL.—The Kinloch Telephone Company officers have given out a positive statement that they will start their new exchange Nov. 1. The Bell Telephone people are also making great improvements in their service. Both companies are charging the same for service.

DUNKIRK, IND.—A new telephone company is being organized here by citizens to compete with the Central Union.

VALPARAISO, IND.—The Porter County Telephone Company has filed articles of incorporation, with a capital stock of $10,000.

INDIANAPOLIS, IND.—It is reported in this city that the Eel River Telephone Company will build a new telephone line through the counties of Wabash, Whitley, Marion and Fulton. The capital stock is $10,000.

GASTON, IND.—The Central Union Telephone Company is arranging to put in a branch exchange at Gaston. It expects to accommodate the farmers as well as the town. The rate will be $1 a month on party lines.

INDIANAPOLIS, IND.—The American Telephone & Telegraph Company, of New Jersey, has capital to the amount of $509,391 represented in this State, according to affidavit made when complying with the foreign incorporations act. The total capital stock is $94,237,500.

LA GRANGE, IND.—The Griffith & Long Telephone Company has sold its entire plant to the Northern Indiana and Southern Michigan Telephone, Telegraph & Cable Company, and the two systems, including a thousand telephones, and exchanges in every town and village in the county, will be under one management.

RADCLIFFE, IA.—A mutual telephone company is being organized here.

DES MOINES, IA.—The Lost Nation and Keystone Telephone Company has filed articles of incorporation. It has $1,000 capital. L. W. Crane, Dan Kommer, H. C. Borgert, E. B. Read, L. Schultz and Freeman Current are the incorporators.

LOUISVILLE, KY.—Louisville Home Telephone Company will erect a three-story brick addition to its exchange building, to cost $30,000.

NICHOLASVILLE, KY.—The Fiscal Court has passed an order requiring the County Superintendent of Roads to remove all poles set presumably by the East Tennessee Telephone Company, a third organization seeking an entrance to the city. The two companies which enjoy the legitimate right to so operate are the Nicholasville Telephone Company and the Jessamine Home Telephone Company.

NICHOLASVILLE, KY.—The Home Telephone Company, of this city, is meeting with phenomenal success. Commencing with a switchboard with 100 numbers, and a dozen outside connections, it now has about 300 subscribers, and nearly a hundred different towns and cities for connections. The latest additions are Lancaster, Burnsides, Crab Orchard, Danville, London, Mt. Vernon, Stanford, Barboursville, and Williamsburg.

FRANKFORT, KY.—A few figures show the activity of the independent telephone companies in the State of Kentucky. There are to-day over 20,000 telephones in use; five years ago there were 500. The capital invested is $3,000,000. There are 83 independent telephone exchanges in the State, and eight in course of construction. The gap has just been closed between Lancaster and Nicholasville, making connection with a dozen towns in the State.

LOUISVILLE, KY.—The organization of the Independent Long Distance Telephone & Telegraph Company here with $1,000,000 capital is another step in the conflict going on between the new Home Telephone Company and the Cumberland, which is the Bell organization. The Home Company is backed by outside capital, but has influential local managers, and it proposes to absorb all the independent lines in the State, the Independent Long Distance Company being organized for that purpose. The Home Company is putting in substantial improvements and promises to begin business Jan. 1.

PORTLAND, ME.—The New England Telephone & Telegraph Company is announcing new and lower rates at the present time. A few free residence telephones will be installed during the month of September for trial until Dec. 31.

BALTIMORE, MD.—The Hughes Telephone Manufacturing Company, capital stock $100,000, has been incorporated by Charles C. Hughes, Edward L. Ward, Wm. Hutcheson, and others.

BALTIMORE, MD.—The Winchester Telephone Company, whose line extends through this city, has been sold to a Pennsylvania syndicate composed of Messrs. S. L. Jones, H. N. Gett, G. D. Gett and T. J. O'Neill, of Hanover, Pa. The line extends over territory in Virginia, West Virginia and Maryland.

HAGERSTOWN, MD.—The Maryland Telephone system in Hagerstown has been bought by the Hanover syndicate, which got control of the telephone systems at Gettysburg, Chambersburg, Westminster and Winchester. Copper wires will be strung to Westminster, where connection will be made with Philadelphia and Baltimore, and with the Virginia long-distance system.

BOYDS, MD.—The Boyds Telephone Company, which has its lines in Montgomery, Frederick and Carroll counties, has sold out a majority of its stock to another company. The purchasers were George D. Gitt, Harry N. Gitt and Thomas J. O'Neil, of Hanover, Pa., and Samuel L. Johns, of McSherrystown, Pa., owners of lines that connect Frederick, Westminster, Gettysburg and Hanover, Pa. This fall they will make connections with the Maryland Telephone Company, of Baltimore.

BOSTON, MASS.—The Erie Telephone system reports a net gain of 1246 subscribers in August, making a net gain since Jan. 1 of 11,448. The number of instruments connecteed on Aug. 31 was 153,047, and those waiting connection 2522.

CITY OF MEXICO, MEX.—Heavy rains have caused much damage to the Federal telegraph lines in the States of Guerrero, Jalisco and Colima, Mexico.

CITY OF MEXICO, MEX.—The cable and telegraph system of Mexico is to be greatly extended in the Western part of the country. The Mexican Government has begun the construction of a cable across the Gulf of California to connect the port of Guaymas with Santa Rosalia, an important town in Lower California. From Santa Rosalia telegraph lines will be constructed to various points on the peninsula. It is also proposed to construct a number of new telegraph lines from Guaymas to points in the States of Sonora and Sinaloa.

PONTIAC, MICH.—It is stated here that the People's Telephone Company of Detroit will soon absorb the Oakland County Telephone Company, of this city.

SOUTH HAVEN, MICH.—E. C. Bickle, of Elkhart, Ind., has purchased of W. E. Herron the Oak Telephone plant. It is said that he proposes to make many improvements.

GRAND RAPIDS, MICH.—The Citizens' Telephone Company has installed an exchange at Grattan. The company now has 120 telephones in service at Lowell, a gain of 50 per cent since Jan. 1.

SAUK CENTER, MINN.—The Central Minnesota Telephone Company is building a four-wire line west from this city.

MORRIS, MINN.—The Stevens County Telephone Company has been incorporated by Dr. H. L. Hubbard, Mr. and Mrs. R. C. Johnson, George E. Dading and George D. Farling, all of Morris. They will control the franchises at Morris and Hancock and will put in a system at Chokio.

BILLINGS, MONT.—L. L. Moffett, who owns the Yellowstone Valley and Bridger telephone line, has leased the Musselshell telephone system.

LOUISIANA, MO.—A new telephone company is being organized to build a system between Hannibal and Ralls County.

CLINTON, MO.—The Mutual United Telephone Company has been incorporated, with a capital stock of $15,000. The incorporators are George R. Lingle, S. T. Neill, W. F. Hall and others.

OMAHA, NEB.—The Southern Iowa Telephone Company has filed articles of incorporation, with an authorized capital stock of $60,000. R. T. Wellslager, L. M. Grimes, J. D. Whisenand and D. N. Smith are the incorporators. The incorporation is the result of a consummated deal between the members of the new company and D. N. Smith, owner of the toll lines in the southwestern part of the State. The company expects to extend its lines to all cities and towns in southwestern Iowa.

RALEIGH, N. C.—The Bell Telephone Company is completing arrangements for placing a part of its overhead system in underground conduits. Mr. F. W. Cutts has the work in charge.

BURLINGTON, N. J.—The Standard Telephone Company was granted a franchise by the City Council.

JERSEY CITY, N. J.—The Eastern Massachusetts Telephone & Telegraph Company has been incorporated in New Jersey, with a capital of $25,000,000. The incorporators are Albert E. Bailey, Almon E. Carpenter and Washington Lithgrow, all of Jersey City.

LITTLE VALLEY, N. Y.—The Independent telephone line from Salamanca to this place and thence to Cattaraugus is rapidly nearing completion.

NEWBURG, N. Y.—The Hudson River Telephone Company's lines have just been extended from Monticello to White Lake, Narrowsburgh, N. Y., and Honesdale, Pa.

MEXICO, N. Y.—The Empire State Telephone Company has erected the poles for a new line between this village and Oswego. The line will be continued to points East.

TROY, N. Y.—At a meeting of the stockholders of the Rensselaer Telephone & Telegraph Company, it was decided to increase the capital stock from $150,000 to $300,000. The company also entered into a contract with the Eastern Electric Construction Company of Philadelphia through its president, Edward Davis,

of Philadelphia, to construct and equip a plant, the principal office being in this city.

HOWARD, OHIO.—A telephone route from here to Gambier has been established and will be built in October.

CIRCLEVILLE, OHIO.—The Citizens' Telephone Company of this city is arranging to equip its plant throughout on the common battery system.

FINDLAY, OHIO.—Efforts are being made by F. E. Kerr and others to establish a farmers' mutual telephone company in and around McComb.

NEW VIENNA, OHIO.—The Central Union Telephone Company is constructing a new toll line from here to Wilmington through New Antioch.

GLOUSTER, OHIO.—The Union Telephone Company has acquired the rights, franchise and lines in Perry County of what is known as the United States Hunnings Telephone Company, and will build a line from this city to Corning.

FINDLAY, OHIO.—A. C. Morse, heretofore manager of the Findlay Home Telephone Company, has accepted a position as constructing engineer for the Federal Telephone Company, of Cleveland. He will be succeeded by Charles Duval, a well known Cleveland telephone man.

MANSFIELD, OHIO.—The Central Union Telephone Company (Bell) is rebuilding its lines from Mansfield to Loudonville, and is building a toll line from Mansfield to connect with an exchange at Savannah. The Mansfield exchange of the company is to be enlarged and new boards added.

CLEVELAND, OHIO.—Following is a statement of the gross and net earnings of the Cuyahoga Telephone Company, of this city, for July, 1900 and 1901: July, 1900: Gross, $17,029.68; $199.28 deficit. July, 1901: Gross, $26,584.38; net, $13,106.18; net increase, $13,305.46.

CLEVELAND, OHIO.—The following statement shows the gross and net earnings of the United States Telephone Company, Cleveland, for July, 1900 and 1901: July, 1900: Gross, $4,543.85; net, $1,973.68. July, 1901: Gross, $14,378.35; net, $6,802.21; net increase, $4,828.53.

TOLEDO, OHIO.—Toledo investors are being offered the bonds of the Toledo Home Telephone Company. The company is building an independent telephone exchange in Toledo, and it is backed by Brailey & Barber, of Wauseon, and Parks & Foster, of Elyria, among the best known independent telephone promoters in the country. It is stated the company will be capitalized at $2,500,000, and that the actual cost to the stockholders will be $650,000. It is claimed that the company has already secured about 5000 subscribers, which at the lowest rate of $24 per year would yield $120,000 per year to start with.

CLEVELAND, OHIO.—The presence in the city of 300,000 G. A. R. visitors had a remarkably enlivening effect upon the business of the telephone companies. General Manager Mark Davis, of the Cuyahoga Company stated that the number of calls over their lines had made an average increase of 25 per cent. The Cuyahoga Telephone Company is improving its service by taking care of outlying villages. This week an exchange is being connected up at South Brooklyn, and next week an exchange at Dover will be cut in. Each will start with about 100 subscribers. Contrary to the usual practice of the independent companies these exchanges will be equipped with party-line telephones if desired. The party line will cost $12 per year, five on a line, while the unlimited service will be $36.

TOLEDO, OHIO.—The Toledo Home Telephone Company has commenced the work of erecting its exchange building on Huron Street. The building will be four stories high, of brick and stone, and will be 120 feet deep and 40 feet wide. It will cost $30,000. The site cost $15,000. The first floor will be used for the offices and counting room and long-distance toll booths. The second floor will be set aside for the comfort and convenience of the operators. There will be a sitting room, dining room, kitchen and toilet room. The long-distance operating room will occupy the rear of this floor. On the third floor will be the local exchange, in which will be located the central energy multiple switchboard of 12,000 capacity, provided by the Kellogg Switchboard & Supply Company, of Chicago. The front of the third floor will be devoted to hospital purposes and to the offices of the matron. The fourth floor will be occupied by recreation, gymnasium and store room. Waxchter Hudson & Company, of Toledo, are the architects.

DAYTON, OHIO.—The Home Telephone Company of this city is now at work on its new building, at the corner of Fourth and Jefferson Streets. The structure will be four stories high, and modern in every respect. The company's system is now under construction. There will be about 100 miles of pole line within the city limits and eight miles of subway. After the city plant is completed the lines will be extended throughout the county, embracing farmers, and the smaller towns desiring to be connected with the Home service. The company states that it now has a list of 2000 subscribers within a radius of two miles of the courthouse, and by the time it is ready for operation it expects to have 5000. Its rates are $40 for business instruments, and $24 for residences. The new exchange, it is expected, will be ready for business by April, 1902. The officers of the company are: John T. Barlow, president; H. D. Critchfield, vice-president; Jas. C. Reber, secretary and treasurer; Maxime Reber, consulting engineer. Mr. W. C. Rickett is superintendent of construction.

BRIDGETON, PA.—The Bell Telephone Company has secured new quarters and will introduce an entirely new system here.

WESTVILLE, PA.—The township committees of Deptford and West Deptford have given franchise rights to the Interstate Telephone Company.

HARRISBURG, PA.—The officials of the Dauphin County Telephone Company will in the near future begin the work of constructing the lines in this place.

PITTSBURG, PA.—The Pennsylvania Railroad Company in this city is making arrangements to have telephones installed in the homes of trainmen, engineers, conductors, brakemen, etc., so as to make it easier for the company to communicate with these men when they are wanted in a hurry. "Call boys" are doing this work now.

PHILADELPHIA, PA.—Plans and specifications have been completed by Architects Paul A. and Seymour Davis, of this city, for the large new telephone exchange building to go up for the Keystone Telephone Company, at Nos. 231, 233 and 235 North Sixteenth Street. It is to be built by George Kessler, at a cost of $54,000. Specifications call for passenger elevators, steam heating, electric lighting, hard-wood finishing.

PARKSTON, S. D.—A company is being organized to put in a telephone exchange at this place.

CHATTANOOGA, TENN.—The American Bell Telephone Company has reached Chickamauga Park in the building of a direct line between Atlanta and Nashville.

DENTON, TEX.—J. D. Carmichael, of Nocoma, has purchased the Denton telephone exchange at a price above $10,000 from S. W. McClure.

AUSTIN, TEX.—The Texas Telegraph Company, of El Paso, has been incorporated; capital stock, $3,000. Incorporators: N. de Bree, P. A. Angus and J. B. de Bree.

GALVESTON, TEX.—At a meeting of the County Commissioners some time ago an application was made by the Texas Construction Company for the privilege of erecting telephone poles along the country road.

MT. PLEASANT, UTAH.—The Rocky Mountain Bell Telephone Company has decided that the branch line from this city to Scofield will not be constructed until next spring.

SALT LAKE CITY, UTAH.—The Bell Telephone Company has completed the Point Lookout branch north of Brigham, and the construction gang is now working on the line to Knudsen duck camp at the mouth of Bear River. The Evanston line to Fort Bridger is completed, and the Lone Tree extension is being pushed.

ELKHORN, WIS.—Permits in the nature of franchises have been granted Company, which will have its offices either in this city or Evansville, will re-Company.

JANESVILLE, WIS.—At a meeting to be held Oct. 11 the Badger Telephone Company, which will have its offices either in this city on Evansville, will report on a plan to refund its debt.

MADISON, WIS.—The Oregon Telephone Company has been incorporated; capital stock, $5,000. Incorporators: W. H. Jones, William Soden, J. M. O'Brien, S. J. Barry, W. L. Ames, J. W. Emmons and H. M. Haskell.

MENASHA, WIS.—At the City Council meeting a communication was read from the Fox River Valley Telephone Company asking that its franchise be transferred to the Independent Telephone Company, which will absorb the Wolf River, Little Wolf River and the Fox River Telephone companies.

FRANKSVILLE, WIS.—A company has been organized here for the purpose of constructing a telephone line from Thompsonville to Racine, running through Franksville. At Racine the intention is to connect with the Bell Telephone Company, or with the Citizens' Telephone Company. At Thompsonville connection is made with several local lines, upon which there are some fifty telephones. Work has already been commenced on the Franksville and Thompsonville branch. The organization comprises the following officers: G. J. Ellis, president; G. G. Adams, vice-president; F. W. Morris, secretary; Dr. J. T. Corr, treasurer.

ELECTRIC LIGHT AND POWER.

SAN FRANCISCO, CALIF.—As a result of the grain handlers' strike in Port Costa, the grain shipping port of San Francisco, Eppinger & Company have installed electric conveyers, which enable one man to do the work of seven in loading grain. Electric apparatus for the same purpose has been in use in Tacoma, Wash., for some time.

ATLANTA, GA.—One of the principal bills coming up before the next session of the Legislature will be one to impose a tax on all corporations securing franchises granted by the State.

HARMONY GROVE, GA.—Dr. G. L. Hardman has secured the services of Prof. Charles Strahan to examine the water power at Hurricane Shoals. A big power plant may be erected here.

DECATUR, GA.—The Georgia Electric Light Company is protesting against the granting of a 20-year franchise to another concern represented by Mr. T. W. Martin. Mr. Martin desires an exclusive franchise from the city for 20 years, the city to have the right to purchase the plant at the end of ten years. Collier & Brown, of Atlanta, have drawn plans for the proposed system.

ALTAMONT, ILL.—The city has awarded the contract to build an electric light plant to T. C. Reed, of Chicago, the cost not to exceed $12,875.

BLUFFTON, IND.—The city of Bluffton has been struggling over a year with the problem of municipal ownership. It owns the street lighting plant and the City Council has refused to grant franchises to private companies, who wanted to put in plants for incandescent lights. The City Council has practically placed an order with a Cincinnati company for a dynamo with which to supply both arc and incandescent lights.

INDIANAPOLIS, IND.—The question of a new electric lighting contract is expected to come up soon after election. The present board, having been once enjoined from opening bids on a new contract, and being threatened with another injunction suit, both the old and new specifications having been complained of as unfair to the Indianapolis Light & Power Company, finally postponed the receiving of bids until after the city election.

TOPEKA, KAN.—T. W. Roby, of Amherst, N. H., will build an electric light plant in Topeka costing $100,000.

NEW ORLEANS, LA.—The Tunica Electric Light & Power Company, Tunica, capital stock $2,500, has been incorporated by Lee Lesser, J. T. Watson, A. I. Dorsey, J. W. Brown, Z. T. White, R. C. Irwin, J. T. Lowe and others.

AUGUSTA, MAINE.—The Standard Light Company of Kittery has been incorporated with a capital of $500,000. F. A. Ray, of Boston, is president, and A. H. Gallagher, Boston, treasurer.

FANNINGTON, MO.—The electric lights were turned on Sept. 5 the first time for six weeks, the plant having been entirely renovated.

HELENA, MONT., in addition to installing 8000 horse-power, further capacity in water-wheels and generators, is constructing a double-pole line between

its plant at Canyon Ferry on the Missouri River and the city of Butte. The distance covered will be about 65 miles, and the company will transmit at 50,000 volts. It will have two circuits of three wires each, and in addition thereto will have a telephone line of two wires, placed on one of the lines of poles. For the power transmission it is using approximately No. 0 seven-strand copper cable. It is now actively in the midst of the construction work, and is in the market for linemen and climbers. Mr. M. H. Gerry, Jr., is general manager.

MERIDA, MEX.—The electric lighting plant of this city has been turned over to the municipal authorities, who will conduct its operation.

CHARLOTTE, N. C.—The property of the Catawba Electric Power Company was sold on Sept. 11 at public auction at Dallas, N. C. The property was bid in by certain bondholders for $175,000.

COLUMBUS, OHIO.—The Columbus Electric Company has submitted a proposition to the Columbus Council to furnish 700 lights at the rate of $74.50 per year each. The city only requires 650 lights, as the municipal lighting plant, soon to be placed in operation again, will furnish 350 lights, 1000 being the total number required. The Columbus Electric Company, however, will not agree to furnish less than 700. A counter proposition will be made by the city.

GUTHRIE, OKLA.—The Mangum Electric Light & Ice Company, of Mangum, Greer County, has been chartered; capital stock, $160,000. The incorporators are J. A. McGeagh, M. Mathews, and J. R. Lone, all of Mangum.

MEYERSDALE, PA.—The electric light plant at Berlin was purchased by C. P. Shupe, of Mt. Pleasant. The price was $5,400, and the plant will be improved.

PITTSBURG, PA.—The People's Natural Gas Company of this city, intends to enter the field of electric lighting as a competitor of the Philadelphia Natural Gas Company, also of Pittsburg, which also controls the Allegheny County Light Company. An ordinance has been introduced in city councils on behalf of the People's Company granting the right to enter upon and occupy all of the streets and alleys in the city for the purpose of constructing and operating poles, conduits, wires, cables and other apparatus, etc., necessary for the supply of electric light, heat and power. The company was chartered some time ago under the name of the City Electric Company of Pittsburg, Pa. I. N. Pew is president of the company.

PHILADELPHIA, PA.—Little has been heard in the past year concerning the patented electric incandescent light which Dr. Auer von Welsbach, the inventor of the Welsbach light, has been working upon, and reference to which was made in the annual report of the Welsbach Company about three years ago. That the matter has not been dropped is confirmed by a director of the company. He says: "This invention, however, and its position so far as the Welsbach Company is concerned, are somewhat removed, and stockholders had best bank on what the company is doing to-day in increasing the volume of its sales of gas mantles, rather than to lay any great stress just now on what may come out of this electric light. The invention itself we consider complete. The difficulty and chief cause for delay has been to find a supply of osmium, one of the rare earths, in sufficient quantity to make it of value commercially."

MONTREAL, QUE.—The recent fight in the Montreal City Council over the granting of the civic lighting contract, which culminated in the Royal Electric Company, getting the contract at $60 per lamp for a period of five years, gives promise of winding up with the disclosure of the methods which were probably used to secure the contract. In the early days of the fight, Alderman Clerihue publicly stated that he had been offered a bribe of $3,000 to vote for the Royal Electric Company. He has now given notice that he will ask the City Council to appoint a committee to investigate the whole matter, and he states that he will, at the same time, give such a committee a full version of the attempt to bribe him.

SALT LAKE CITY, UTAH.—Utah is to have another large electric-power plant. The company has been organized and articles of incorporation will be filed, probably in New Jersey. The manager of the enterprise is W. C. Weaver, receiver of the Bear River Irrigation Company, and his associates comprise New York, Chicago and Salt Lake capitalists. The power-house will be built just south of Collinston in Box Elder County. It is the intention to erect a plant that will generate 5000 e. h. p. Pole lines will be run to Salt Lake, Ogden and Park City, as well as to Bingham. The plant will cost $1,000,000, and, it is stated, arrangements have been completed to float the bonds in the East.

FREDERICKSBURG, VA.—The new electric light plant built for the city was started up recently.

MORGANTOWN, W. VA.—The Morgantown Electric Light & Power Company has sold its plant and franchise to a syndicate of citizens composed of I. O. White, R. D. Hirschman, Frank Cox, W. E. Glasscock, Joseph H. McDermott, and R. E. East for $14,000. The plant will be enlarged and an electric railroad is in contemplation.

PETERSBURG, VA.—The Southside Railway & Development Company proposes to develop a water-power, two miles from the city, on the old canal. It is stated that a fall of 100 feet can be secured, and that with contemplated improvements sufficient electric power can be obtained to supply the electric light and electric railway system. The company contemplates building an electric railway between this city and Richmond.

SEATTLE, WASH.—The Montesano Light & Water Company, Montesano, Wash., was organized in March last, with a capital stock of $100,000. Mr. C. H. Kiehl, of Seattle, is president and purchasing agent, and Mr. A. H. Dimock secretary. The company uses Stanley equipment, including one 50-kw alternator and Stanley transformers of 500-lights capacity. This plant is operated by a 75-hp Stilwell-Bierce & Smith-Vaile turbine.

SEATTLE, WASH.—The Northwest Light & Power Company was organized June last to conduct an electric light service at Skaguay, Alaska. The capital stock of the company is $200,000, Mr. C. E. Shepard being secretary. Mr. C. H. Kiehl, Seattle, is purchasing agent of the company. Stanley Electric Manufacturing Company apparatus is used, the equipment consisting of one 100-kw alternator, and Stanley converters of 1200-lights capacity. The power-house is constructed of wood and corrugated iron. The steam equipment includes one Babcock & Wilcox boiler of 150-hp capacity and one Ideal engine of the same rating.

THE ELECTRIC RAILWAY.

MOBILE, ALA.—The consolidation of the two street railways of Mobile has gone into effect.

VANCOUVER, B. C.—It is the intention of the British Columbia Electric Railway Company to double the capacity of its power-house in Vancouver, and to put in a complete lighting plant. Mr. Horne Payne is the managing director of the company.

WILMINGTON, DEL.—The United States Traction Company, of New York, has been chartered here; capital stock, $3,000.

ALTON, ILL.—A new 750-hp engine and a 90-kw dynamo were placed in the power-house of the Alton Railway & Gas & Electric Company, Sept. 9. The new dynamo is three times the size of the old one.

LA PORTE, IND.—A franchise has been granted by the La Porte County Commissioners to the Chicago, Valparaiso & Michigan City Railway Company.

INDIANAPOLIS, IND.—The Cincinnati & Indianapolis Traction Company, organized for the purpose of building an electric railway from Indianapolis to Cincinnati, has been incorporated; capital, $10,000.

GOSHEN, IND.—The Goshen Southern Traction Company, with a capital of $50,000, has been incorporated. The following are the directors: L. W. Vail, L. M. Latta, M. V. Starr, J. A. Beane, C. A. Wehmeyer.

AURORA, IND.—With the exception of the crossing at Wilson Creek, the Cincinnati, Lawrenceburg & Aurora Electric Railway Company has obtained all the rights of way for the extension of its line from Aurora to Vevay, via Rising Sun.

PLAINFIELD, IND.—There will be an electric railway between Plainfield and Indianapolis within eight months if plans for it are carried out. The Plainfield & Western Company has awarded a contract to an Eastern firm for the construction of the road. The power-house will be located at Plainfield.

LOUISVILLE, KY.—The United States Traction Company, of Louisville, Ky., has been incorporated; capital, $30,000.

NEW ORLEANS, LA.—The board of directors of the New Orleans City Railway Company have agreed to accept the offer of H. H. Pearson, Jr., acting for Brown & Company, of Philadelphia, and representing Philadelphia capitalists, for the lease or purchase of their lines, thirteen in number, and to recommend the stockholders to accept the offer.

AUGUSTA, ME.—The Augusta & Warren Electric Railway Company has been organized. The company is capitalized at $300,000. The promoters are Governor John F. Hill, J. Manchester Haynes, G. E. Macomber, H. P. Vickery and T. J. Lynch.

MONTEREY, MEX.—Negotiations looking to the purchase and consolidation of the street railway systems of Monterey are pending. If the deal is consummated the new owners will introduce the electric system.

CITY OF MEXICO, MEX.—Ramon Miranda y Maron, who was granted a concession for the building of a street railway in the suburb of the City of Mexico, known as the Colonia Americana, has been granted an extension of time by the Government in which to complete the line.

CITY OF MEXICO, MEX.—The Belt Railway Company, which was organized about a year ago with a capital stock of $600,000, will soon begin the construction of an extensive street railway system in this city, the Mexican Government having recently granted it a concession to build and operate the proposed system. This concession covers two hundred streets. The company has already built a short suburban line in the Federal District, in which the City of Mexico is located. Arthur E. Stilwell, president and general manager of the Kansas City, Mexico and Orient Railroad, is said to be a heavy stockholder in the company.

BATTLE CREEK, MICH.—The Michigan Traction Company has sold the Battle Creek and Kalamazoo Interurban road and the lines within the city of Battle Creek and Kalamazoo, consisting of forty-seven miles of track, to W. A. Boland, promoter of the Detroit & Chicago Traction Company.

BILOXI, MISS.—The stockholders of the Biloxi Street Railway Company have unanimously agreed to dissolve the corporation and divide the moneys on hand. The company determined to retain its charter, however, in view of the possibility of reorganization.

DURHAM, N. C.—The Durham Traction Company has let the contract for the construction of eight miles of electric lines within the city limits.

CONCORD, N. H.—Articles of agreement have been filed with the Secretary of State for the formation of the Dover & Eliot Street Railway Company. The capital stock is $25,000.

NEW YORK, N. Y.—The contract to construct the recently incorporated New York and Portchester Railway has been awarded to John B. McDonald, who is building the New York Rapid Transit subway.

NEW YORK, N. Y.—The contract for the construction of the proposed trolley line from the Annadale railway station to Richmond Beach, Staten Island, has been awarded to L. W. Serrell, of Manhattan, for $30,000.

ALBANY, N. Y.—The Oneida Traction Company has been incorporated, to build an electric road, ten miles long, from Canastota to Sherrill, Oneida County. The capital stock is $500,000. The directors are Henry C. Stone and others, of Oneida.

JAMAICA, L. I.—A new trolley line, under the title of the South Jamaica Electric Transportation Company, is being organized. John A. Anderson, Brooklyn, is the legal representative of the corporation. Some of the incorporators will be James F. Tibbits, of Syracuse; T. W. Mandover, Manhattan, and C. J. Shaw, of Far Rockaway.

CAMDEN, N. J.—Articles of incorporation were filed in the County Clerk's office by the St. Louis & Illinois Suburban Railway Company, with an authorized capital of $3,000,000. The new company will absorb the St. Louis Traction Company and several small suburban roads.

HAMILTON, OHIO.—Peter Schwab, of Hamilton, promoter of the Eastern Indiana Traction Company, has secured a franchise through Winchester, Ind.

CLEVELAND, OHIO.—Rumors are again numerous to the effect that the Everett-Moore syndicate will soon gain control of the Cleveland City Railway Company.

KENTON, OHIO.—The Hardin County Commissioners have granted a franchise through this county to the Toledo, Columbus, Springfield & Cincinnati Railway Company.

MAUMEE, OHIO.—An ordinance has been presented to the Council of Maumee asking for a franchise through town for a line which will parallel the Toledo & Maumee Valley.

MARYSVILLE, OHIO.—Representatives of the Toledo, Columbus, Springfield & Cincinnati Railway are securing right of way through Union County for the line to Columbus.

YOUNGSTOWN, OHIO.—Official announcement has been made of the organization of the Youngstown, Sharon, Sharpsville and Wheatland street railway, lighting and heating properties.

CLEVELAND, OHIO.—The Findlay & Southern Railway has placed a contract with the Ohio Construction & Financing Company for the construction of the road through Union County.

BOWLING GREEN, OHIO.—The Wood County Commissioners have granted franchises through the town to the Toledo, Bowling Green & Southern Railway and to the Lake Erie, Bowling Green & Napoleon Railway.

LEBANON, OHIO.—The Hamilton County Commissioners have granted a franchise along the Montgomery Pike to the Rapid Railway Company, of Cincinnati, for its line from that city to Dayton by way of Lebanon and Mason.

CLEVELAND, OHIO.—A report comes from Toledo to the effect that the Everett-Moore syndicate has acquired the Toledo & Maumee Valley Railway, running from Toledo to Perrysburg. It is said that $750,000 was paid for the property.

MANSFIELD, OHIO.—Work has been started between Crestline and Mansfield on the Galion, Crestline & Mansfield Railway. Considerable track has been laid on the line between Galion and Crestline, and it is claimed the entire road will be in operation by January 1.

HAMILTON, OHIO.—The Mill Creek Valley Electric Railway Company has started its new power-house at Hartwell, and the plant and headquarters at St. Bernard are to be abandoned. The road is now in first class running order from Cincinnati to Hamilton.

CHILLICOTHE OHIO.—Contracts for the electrical equipment, power-house and sub-station machinery of the Chillicothe & Hillsboro Traction Company have been let. All other contracts are to be let in a few days. R. A. Crandall, of Chicago, is at the head of the syndicate controlling the road.

CLEVELAND, OHIO.—The Toledo & Western Railway has filed a mortgage in Toledo in favor of the Western Reserve Trust Company, of this city, securing payment of an issue of $1,250,000 of 5 per cent gold bonds. It covers all the property of the company in Lucas and Fulton counties, Ohio and Lenawee County, Mich. The road is already in operation in these counties.

LISBON, OHIO.—Hait & Smith, Cleveland attorneys, who some time ago secured franchises for a line from Salem to Lisbon and East Liverpool, but who permitted them to expire through failure to commence work, are again in the field and claim they have secured Eastern backing sufficient to carry out the project. They are endeavoring to secure extensions of the old franchises.

CLEVELAND, OHIO.—A newspaper report from Steubenville intimates that the Everett-Moore syndicate has secured control of the Steubenville, Mingoe & Ohio Valley Traction Company. The report probably arose from the fact that Mr. Moore is a director in the Wheeling Traction Company, which is planning a number of extensions into Ohio, among them a road to Steubenville from Bridgeport.

CONNEAUT, OHIO.—The Conneaut & Southeastern Railway, which was recently incorporated, has organized as follows: Directors, F. J. Cheney, G. M. Brown, George J. Chapman, A. M. Cox, G. W. T. Watson and George Cleveland, G. J. Chapman, president; W. F. Stanley, vice-president; George H. Cleveland, secretary; G. M. Brown, treasurer. Right of way between Conneaut and Pierpont is being secured, and it is stated that construction work will start in the spring.

CLEVELAND, OHIO.— A dispatch from Detroit quotes H. A. Everett as saying that stock is rapidly being deposited for the bonds in the new Michigan corporation promoted by the Everett-Moore syndicate, and that within thirty days the consolidations will be completed and the properties of the Detroit United Railways will be turned over to the new company. Mr. Everett stated that the Toledo & Detroit Shore Line between Toledo and Monroe will be equipped with electricity in place of steam.

OTTAWA, ONT.—The luxurious electric car which has been provided by the Ottawa Electric Railway Company expressly for the use of the royal party, upon the occasion of the visit to Ottawa, is 50 feet in length, is vestibuled at both ends, and has a full monitor roof of the Pullman type. The interior is finished in antique polished oak. The car is brilliantly illuminated by five clusters of incandescent electric lamps, twenty-one in all. The electric equipment consists of four Westinghouse, 50-horse-power motors. The car is also fitted with the Westinghouse air brake, and is capable of attaining a speed of fifty miles per hour. This is the first electric tram car ever provided exclusively for the use of royalty.

WILLIAMSPORT, PA.—A charter has been granted to the Whitemarsh & Upper Dublin Street Railway Company, which is capitalized at $36,000.

DOWNINGTOWN, PA.—The Town Council passed an ordinance allowing the Tennis Trolley Company to use the streets of the burg.

BLOOMSBURG, PA.—The Berwick Town Council has granted the Columbia & Montour Electric Railway the right of way through the town's streets.

WILLIAMSPORT, PA.—A charter has been granted to the Whitemarsh & Upper Dublin Street Railway Company, which is capitalized at $36,000.

BLOOMSBURG, PA.—The Catawissa Council has granted the Columbia & Montour Electric Railroad the right of way through the streets of that borough.

DOYLESTOWN, PA.—The stockholders of the Quakertown Traction Company have authorized an increase in the capital stock of the company from $150,000 to $300,000 and an increase in the bonded indebtedness from $150,000 to $300,000.

HARRISBURG, PA.—The Cambria Street Railway Company has been incorporated by Frank G. Harris, Clearfield; F. L. Snyder, of Kylertown; W. H. Sandford and E. C. Brown, of Patton; J. E. Hedding, of Morrisdale; A. E. Patton, of Curwensville; James Kerr, of Clearfield; I. A. Sweigard, of Philadelphia; A. G. Palmer, of Corning, N. Y.; Fred. G. Harder, of Harrisburg, and T. Stewart Pierce, of Saltsburg.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway Company will expend $80,000 in general improvements.

FORT WORTH, TEX.—The North Texas Traction Company, which is building the interurban line to connect Fort Worth and Dallas, has closed a contract for the erection of the power-house at Handley, to cost $250,000.

MILWAUKEE, WIS.—The Milwaukee, Burlington & Lake Geneva Railway Company has been granted a franchise for the Milwaukee end of the line.

WAUKESHA, WIS.—The Milwaukee Electric Railway & Light Company will build a new power plant in this city to handle the Waukesha Beach line, and half of the Milwaukee-Waukesha line. The present power plant is poorly located, and has become inadequate.

ELKHORN, WIS.—A franchise has been granted to George J. Hurd, of Janesville, Wis., for the construction and operation of an electric railway through this city. This is the Janesville, Elkhorn & Lake Geneva line. H. H. Clough, promoter of the Janesville, Beloit & Delavan Lake electric railway, has also applied for a franchise.

THE AUTOMOBILE.

THE MOBILE TRANSIT COMPANY has been organized in McKeesport, Pa., and will operate a number of automobiles and carry passengers at 5 cents per fare from the downtown district to the residence portion of the city on the surrounding hills. Mr. James Evans, president of the National Bank of McKeesport, is the promoter of this new enterprise.

ELECTRIC OMNIBUSES.—The Western Navigation Company, which operates steamers between San Francisco and Alviso, has ordered six electric omnibuses from an Eastern firm. On their arrival an electric 'bus line will be put into operation between Alviso and San Jose, making close connections with the San Francisco steamers. The service will later be extended beyond San Jose.

NEW INDUSTRIAL COMPANIES.

THE ELECTRIC LIGHT AND RAILWAY EQUIPMENT COMPANY, of Newburg, N. Y., has been incorporated, with a capital stock of $60,000.

THE MAYAGUEZ ELECTRIC COMPANY, capital $100,000, has been incorporated by Cecil D. Giles, New York; Oscar L. Gubelman, Jersey City, and Frank H. Lord, New York.

THE HOGAN MOTOR COMPANY, of West Haven, Conn., has been incorporated in New Jersey; capital, $75,000. Incorporators: Frederick Brown Wells, Edwin S. Thomas, John J. Hogan.

THE CENTRAL ELECTRIC & CONSTRUCTION COMPANY, Princeton, N. J., has been incorporated; capital, $5,000. Incorporators: Chas. P. Fitch, Wm. W. Parsons, George B. Parsons.

THE MOBERG ELECTRIC CLOCK COMPANY, of New York City, has been incorporated; capital, $350,000. Directors: A. E. Schatz and George Meder, of Mount Vernon, and J. M. Lincoln, of New York City.

THE ELECTRICAL PORCELAIN COMPANY has been organized at East Liverpool, Ohio, with $30,000 capital. The incorporators are William Erlanger, William Erlanger, Jr., S. C. Dyke, Harry Peach and R. J. Marshall.

THE MANUFACTURING ELECTRICAL NOVELTY COMPANY, of New York City, has been incorporated at Albany, to manufacture and deal in electrical apparatus and electrical goods of all kinds. The capital stock is $10,000.

THE YOST-MILLER COMPANY, of Toledo, Ohio, has been incorporated, with $25,000 capital stock, to manufacture electrical supplies and novelties. The officers are: J. L. Yost, president; George F. Miller, Sr., secretary; Charles A. Yost, general manager. Directors, the above and L. P. Dickinson and O. E. Kennedy.

THE BANKERS' AND TRADERS' COMPANY, of New York City, has been incorporated to do a general contractor's business, to operate foundries and rolling mills, to supply electricity, to deal in real estate, and to promote business enterprises; capital, $250,000. Directors: Horace C. Hunt, Rockland, Mass.; James J. Allen, and Charles A. Decker, New York City.

LEGAL.

PAN-AMERICAN.—The Pan-American Exposition Company, of Buffalo, has been sued in the Supreme Court, New York City, by the Mayo & Rohrer Company, dealers in electrical supplies. In addition to the action here, a mechanics' lien for $2,929.65 has been filed by the plaintiffs in Erie County. This lien is for the amount said to be due, and is placed on all the buildings of the Exposition.

PERSONAL.

MR. N. WETMORE HALSEY, for many years connected with N. W. Harris & Company, the bankers handling electric railway and lighting securities, has formed the firm of N. W. Halsey & Company, to deal in railroad bonds and other securities at 49 Wall Street.

MESSRS. NORMAN C. SAWERS and D. McNaught, of the India Rubber, Gutta Percha & Telegraph Works Company, Limited, of Silvertown, England, sailed by the "Umbria" on Saturday last for home after a most enjoyable month in this country, including the Institute meeting, the Pan-American, and a trip West.

MR. D. L. HUNTINGTON, secretary and manager of the Washington Water Power Company, of Spokane, Wash., is one of the few far western men that came east to attend the Edison convention. This year Mr. Huntington came not only to Buffalo for that convention last week, but to New York, and paid the ELECTRICAL WORLD AND ENGINEER a visit. Mr. Huntington has one of the best maintained systems of street railway and electric lighting the far northwest.

MR. R. C. P. HOLMES, the purchasing agent of the Chicago Edison Company, met with a most serious accident on Sept. 6 while riding on an Illinois Central suburban train. He was on the last car of the train and fell off the platform, both hands being engaged in lighting a cigar. He struck his head, receiving a severe scalp wound, while his collar bone and three ribs were broken. These injuries are fortunately not fatal, but Mr. Holmes will be an invalid for some time to come.

MR. W. WAMPLER, lately with the Peckham Manufacturing Company, has undertaken to handle the railway supplies of the Stuart-Howland Company, Boston, in New York, Pennsylvania, Delaware, New Jersey and Maryland. He has been connected for twelve and a half years with street railway work. He was one and a half years mechanical superintendent for the Union Railway Company, of New York, and then in the same capacity with the Atlantic Avenue road in Brooklyn. He resigned to become superintendent of rolling stock and equipment for the Union Traction Company of Philadelphia, remaining four years, when, in 1898, he became associated with the Peckham interests.

MR. H. L. SHIPPY, New York manager for the Roeblings, had one of the "closest calls" of his life last week, when the fine 120-foot McCormick steam yacht "Rapidan" was wrecked in a northeast gale off Cape Henlopen, Delaware. The party and crew were landed with great difficulty in surf boats, after it was found that the breeches buoy could not be used by the Life Saving Corps. The yacht was to have been employed by the Roeblings for the entertainment of their friends during the cup races. Mr. Shippy is one of the most popular and highly esteemed men in New York in electrical and mechanical circles, and his office on Liberty Street has been visited by a host of friends desirous of expressing to him in person their heartfelt congratulations on his narrow and lucky escape.

EDUCATIONAL.

COOPER UNION DAY SCHOOLS.—A prospectus of the free day classes in civil, mechanical and electrical engineering and chemistry has just been issued by Cooper Union, New York. These classes were started last year, and afford many parents the opportunity of sending their sons to some engineering institution of learning.

Trade Notes.

CHANGE OF NAME.—The Electric Heat & Power Company, Chicago, has changed its name to Pearce Construction Company.

THE STANDARD TOOL COMPANY, Cleveland, Ohio, has issued a neat pamphlet in Spanish describing and illustrating its lines of drills, taps, etc.

THE ELECTRIC APPLIANCE COMPANY, of Chicago, has just closed several large contracts for hotel telephone equipments. It has a special catalogue covering this work which it is sending upon application.

OIL FILTERS.—The Calumet & Hecla Copper Mining Company, the largest copper mining company in the world, has ten Cross oil filters in successful use in its mines. They were furnished by the Burt Manufacturing Company, of Akron, Ohio.

STEAM SPECIALTIES.—The Wright Manufacturing Company, Detroit, Mich., in an 18-page pamphlet describes and illustrates its steam specialties, including safety water columns, feed water controller, steam traps, etc. Price lists of the various goods are also included.

DROP HAMMERS AND TRIMMING PRESSES, as manufactured by the E. W. Bliss Company, Brooklyn Borough, New York, are illustrated, and their principal features pointed out in a 24-page pamphlet just issued by the company. The Bliss Company makes a very complete line of standard machines and tools.

DRILL PRESSES.—The Knecht Brothers Company, Cincinnati, Ohio, is making a friction drill press, for which many points of excellence are claimed. The driving mechanism consists of two cones and a friction roller. The power is transmitted from the lower cone to the friction roller, which transfers the power to the upper or spindle cone, and the speed of the drill spindle is increased or diminished instantly without stopping the machine or shifting belts.

STEAM HOT BLAST APPARATUS.—Included in the extensive line of manufactures of the B. F. Sturtevant Company, Boston, Mass., is a steam hot blast heating and drying apparatus, which forms the subject of a special pamphlet of recent issue by that company. This apparatus has been developed to a point where it can be readily built in any proportions and adapted to the most peculiar requirements. The entire heating surface is massed in a fireproof casing in connection with the fan, which can be driven by belt, engine or electric motor, as desired. Several illustrations show the different styles of apparatus. At the back of the pamphlet are given some tables for calculations in pneumatics.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, is introducing a new "S. L." arc lamp hanger board with absolute cut-out, for series direct or series alternating arc lamps, for use both indoors and outside. It regards this board as by far the strongest and practically the best it has ever seen, and its success with it has been more than satisfactory. The body of the board is made of extra heavy, solid porcelain, with very handsome black enameled hood. All the exposed parts have a highly glazed surface, and there is no fibre or mica on it to give out. It has a closed top, and the switch is perfectly air and water tight, and it has ¾-inch break. The company has gotten out a very handsome bulletin illustrating this, which is mailed on application.

TROLLEY TRIPS are becoming the subject of a special branch of travel literature, and have led to the production of some excellent Murray and Baedeker guides in miniature. The latest of these to reach us is "Trips by Trolley Around Hartford," in handsome yellow paper cover, which for 10 cents gives an admirable idea of the parks, roads, historical haunts, fine homes, monuments, etc., of the whole region. It is profusely illustrated with half tones and maps, and, as usual, can be slipped in the coat or hip pocket for consultation. An interesting feature are the trips laid out from Hartford south to New York and north to Boston. The compilation is due to Mr. Herbert O. Warner, and the enterprising publishers are White & Warner, Hartford, Conn.

INTERCHANGEABLE ARC LAMPS.—The General Electric Company has just issued a handsome pamphlet, No. 1032, on the subject of interchangeable arc lamps. It points out the manner in which central stations called upon to furnish alternating and direct low-tension current and to operate at least three different kinds of enclosed arc lamps, can carry a supply of a few parts by means of which lamps installed for alternating-current service can be readily changed over for operation on direct-current; while lamps can also be changed from 110 to 220-volt multiple service with equal facility. The pamphlet shows in detail the various parts necessary to effect such changes and explains the mechanism, and is illustrated also by a variety of cuts showing the application of the enclosed arc in interior spaces, show windows, etc.

INSULATED WIRE EXHIBIT.—The Hazard Manufacturing Company, Wilkesbarre, Pa., is making an attractive exhibit at the Pan-American Exposition, of its complete line of insulated wires and cables, also samples of its wire rope manufactures. The company was established in 1848, but recently extended its works to include the manufacture of electrical conductors. The range of these latter products includes weatherproof and rubber covered wires and cables, magnet wires of all shapes, cotton and silk covered, and special conductors. The company is distributing at its Pan-American booth two handsome pamphlets descriptive and illustrative of its products, in both of the abovenamed lines. Views of the various departments of the electric wire mill are shown, together with illustrations of wire samples. The pamphlet on wire rope products is completely and attractively illustrated.

"STEAM."—One of the best known trade catalogues is that with the above title issued by the Babcock & Wilcox Company, of New York and London, a thirty-second edition of which has recently reached us. The book appears in its time-honored cloth cover of deep blue and gold, and comprises some 130 pages of technical matter and illustrations, and lists of plants, in which the well-known water tube boiler of the B. & W. make has been installed. It is needless at this late date to comment upon the value of the excellent technical data as to boilers, steam engines, etc., brought together in this valuable pamphlet, but one becomes more and more impressed in looking over the pages to note the growing variety and magnitude of the plants and buildings in which these boilers have been installed, not only in this country, but throughout the world. The book is prefaced with a very handsome half-tone illustration of the large new works of the company at Bayonne, N. J.

RECONSTRUCTED ARMATURES.—A very interesting pamphlet issued by the Gregory Electric Company deals with "reconstructed armatures," a specialty to which it has been devoting considerable attention with corresponding success. It must not be understood that these armatures are merely rewound. They are "created anew," old surface wound being made, for example, into the latest improved toothed and slotted types, with consequent increase in efficiency. The changes made in this way on some of the earlier alternating current machines are quite remarkable, and the pamphlet contains explanations and a large amount of data. Details are also given as to rewinding transformers, direct current armatures, refilling commutators, making repairs on street railway machinery, etc. The concern is also putting in self-oiling bearings to take the place of oil cup bearings in the old surface wound generators. In short, as an exposition of the manner in which apparatus that would otherwise grace the scrap heap can be made over into efficient modern mechanism, the booklet deserves to be very widely read and acted upon.

ORDERS FOR HARRISBURG ENGINES.—In addition to the foreign and domestic orders, reported last week, Mr. W. P. McKenzie, New York agent for the Harrisburg Foundry & Machine Works, notes the following: The North Milwaukee Vulcanized Rubber Company, of Morrisville, Pa., has ordered a 40-hp standard simple engine for direct connection to a Stanley 25-kw generator. The Townsend & Downey Shipbuilding & Repairing Company, of Shooters Island, is to have a 150-hp standard simple engine, direct connected to a 100-kw generator, built by the Westinghouse Electric & Manufacturing Company. The Arlington (N. J.) Manufacturing Company has ordered a 120-hp standard simple engine to be direct connected to a 75-kw Eddy generator. The Edward Malley Company, of New Haven, Conn., has ordered two 120-hp Ideal engines for direct connection each to a 75-kw generator manufactured by the Bullock Electric Company. An order has also been received from the Thomson-Starrett Company, of 51 Wall Street, for one 115-hp and one 75-hp Harrisburg standard simple engine to be installed in the building to be erected corner of William and Cedar Streets, New York City. These engines will be direct connected to 75-kw and 50-kw generators of Westinghouse manufacture.

THE RISDON-ALCOTT TURBINE COMPANY.—The well-known firm of T. C. Alcott & Son, of Mount Holly, N. J., have acquired by purchase the entire plant, including all patterns, patents, etc., of the John W. Taylor Manufacturing Company, formerly and better known as the T.

H. Risdon & Co., manufacturers of the celebrated Risdon turbine and the Taylor sleeve gate turbine. The combined plants of these companies will be hereafter operated to their fullest capacity by the incorporators, Thomas J. Alcott and his two sons, Edgar A., and Howard E. Alcott, under the name of the Risdon-Alcott Turbine Company. Their product will be turbines and appurtenances almost exclusively, comprising the large assortment of patterns of the Risdon turbine, in cylinder and outside register gate styles, the Holyoke test records of which have never been excelled. Also the high duty turbine of inside register gate pattern, which has been recognized for years as a first class wheel in every particular, and one that could always be depended on to give satisfaction; also the Taylor sleeve gate turbine, which is a wheel of very large capacity. This is one of the newer wheels, and has yet to establish its name, but with the recognized ability of the Alcotts as water wheel builders this is assured. The wide range of power and speed covered by the different sizes and patterns controlled by this company makes it possible for them to fulfill the requirements of almost any situation. The greatly increased facilities of this company in the way of new buildings and new tools and appliances enable them to handle work of large magnitude with considerable dispatch. The new company will be glad to send their catalogues to any users of water power who may be interested in high-grade turbines.

Record of Electrical Patents

UNITED STATES PATENTS, ISSUED SEPT. 10, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

682,165. CONTACT DEVICE FOR ELECTRIC RAILWAYS; W. M. Brown, Johnstown, Pa. App. filed Jan. 8, 1901. Details of construction of a sealed box in the roadbed, the contacts in which are brought together by a magnet carried by the vehicle.

682,184. ELECTRIC LIGHTING BY LOW FREQUENCY CURRENTS; W. C. Fish, Lynn, Mass. App. filed Jan. 26, 1901. (See Current News and Notes.)

682,187. TROLLEY WIRE SUPPORT; W. Gerard, St. Bernard, Ohio. App. filed Jan. 17, 1901. The trolley wire is deflected in its passage through the clip and is clamped therein.

682,203. STATIC MACHINE; T. B. Kinraide, Boston, Mass. App. filed March 5, 1901. The machine is provided at the receiving terminal with means for preventing discharge, and at the opposite terminal with means for freely permitting discharge.

682,204. DEVICE FOR INDICATING LEAKS IN INSULATION OF ELECTRIC CONDUCTORS; I. Kitsee, Philadelphia, Pa. App. filed Jan. 24, 1900. An indicating device, one terminal of which is connected to the circuit proper and the other to a conductor insulated from, but in close proximity to, said circuit.

682,205. RECORDING DEVICE; I. Kitsee, Philadelphia, Pa. App. filed March 16, 1900.

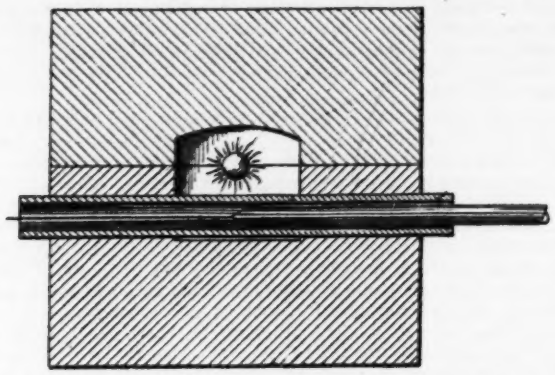
682,215. BUSHING FOR ELECTRICAL CONDUITS; M. Mauer and W. J. Billings, New York, N. Y. App. filed Feb. 19, 1901. The bushing is eccentric in shape, and passes into an eccentric hole through which the conduit projects, and is locked therein by a slight rotation.

682,217. CIRCUIT BREAKER; F. A. Merrick, Johnstown, Pa. App. filed Jan. 18, 1900. Details.

682,219. ELECTRIC REGULATOR; M. Moskowitz, New York, N. Y. App. filed Sept. 27, 1900.

682,220. AUTOMATIC REVERSING SWITCH; M. Moskowitz, New York, N. Y. App. filed Sept. 27, 1900.

682,233. OUTLET BOX FOR INTERIOR CONDUITS; W. F. Bossert, UTICA, N. Y. App. filed July 20, 1901. A metal outlet box, having one or more partially formed openings in its walls, each opening being circular in configuration, the peripheries of the openings and of their partly-expelled blanks being mutually indented.



682,337.—Manufacture of Incandescing media for Incandescent Lighting.

682,300. ELECTRICAL POWER TRANSMISSION SYSTEM; N. G. Warth, Indianapolis, Ind. App. filed Feb. 11, 1900. To generate direct currents of high potential by utilizing the output of a number of direct-current generators without causing the generated current to pass through each generator, a number of secondary batteries are serially connected with each other and with the transmission line, and operated simultaneously with the generators.

682,324. ELECTRIC HEATER; J. P. Erie, New York, N. Y. App. filed Sept. 22, 1900. Mechanical arrangements for uniting heater sections.

682,332. MEANS FOR AUTOMATICALLY REVIVING EXHAUSTED TELEPHONE PULSATIONS; M. C. Mengis, Sheepshead Bay, N. Y. App. filed Aug. 31, 1899. Details of a telephone repeater.

682,333. TELEPHONE TRANSMITTER; M. C. Mengis, Brooklyn, N. Y. App. filed Feb. 15, 1900. A button on the diaphragm fits into a cavity in a number of contact sections.

682,337. MANUFACTURE OF INCANDESCING MEDIA FOR INCANDESCENT LIGHTING; R. A. Nielsen, Copenhagen, Denmark. App. filed July 14, 1900. Oxids of the rare earths are subjected to the heat of the arc while shielded from the electrolytic decomposing action of the arc, until the said oxids are melted, whereupon they are drawn out into threads.

682,351. FREQUENCY INDICATOR; C. C. Chesney and W. J. Lloyd, Pittsfield, Mass. App. filed May 25, 1901. (See Current News and Notes.)

682,377. ELECTROMAGNET; T. H. Wurmb and R. Baumann, St. Louis, Mo. App. filed April 9, 1900. Details.

682,380. ELECTRIC BELT; W. M. Davis, Springfield, Mo. App. filed April 9, 1900. Details.

682,381. ELECTRIC TRACTION ROAD; L. Dion, Boston, Mass. App. filed Jan. 28, 1901. The system is of that class in which the conductor is lifted by magnetism into contact with an exposed stud in the roadway.

682,392. TROLLEY; J. A. Thompson, McDonald, Pa. App. filed April 18, 1901. Details.

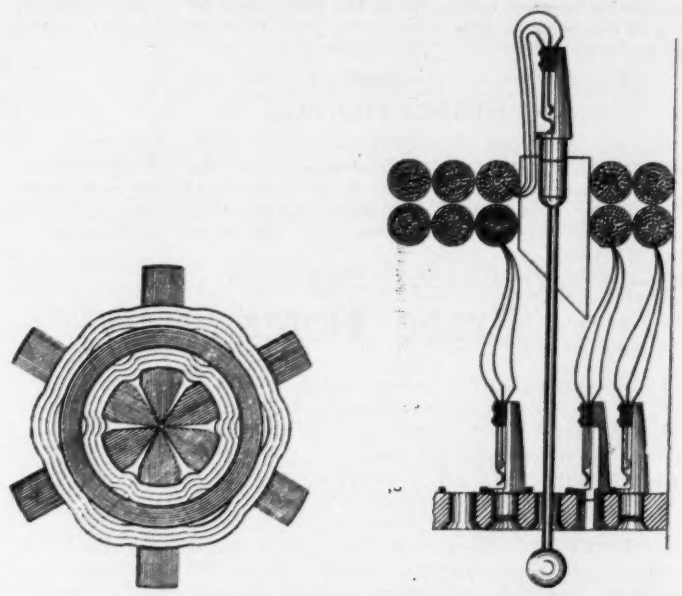
682,417. ELECTRIC BATTERY; W. Mills, Elizabeth, N. J. App. filed Oct. 3, 1900. The carbon cylinder is provided with radial insulated pins which prevent contact with the zinc cylinder.

682,428. STATION INDICATOR; E. A. Russell, Newark, Ohio. App. filed Aug. 16, 1900. A belt carrying the station names, is moved by the action of a solenoid.

682,433. RESONATOR; J. F. Skirrow, East Orange, N. J. App. filed Feb. 15, 1901. A resonator for telegraph sounders adapted to increase and direct the sound to the ear of the operator.

682,458. TELEPHONE PROTECTOR; A. Deck, Franklin Township, Montgomery County, Ind. App. filed June 12, 1901. Details.

682,475. PRIMARY BATTERY; S. W. Maquay, Chertsey, England. App. filed Aug. 6, 1900. The carbon electrode is provided with a number of recesses, into which projections from the zinc electrode extend.



682,520.—Electrical Transformer. 682,566.—Mechanism for Removing or replacing Switchboard Jacks.

682,520. ELECTRICAL TRANSFORMER; A. F. Berry, London, Eng. App. filed Jan. 23, 1901. As a new article of manufacture, a laminated iron block adapted to form part of a transformer-core and composed of long straight parallel strips of sheet iron of different widths held side by side with the ends of alternate strips arranged to overlap the corresponding ends of the intermediate strips.

682,540. ELECTRIC SWITCH; C. E. Gaffney, Pawtucket, and F. A. Tibbetts, Providence, R. I. App. filed May 20, 1901. Improvements in the switch tongue to reduce the friction in motion.

682,554. REGULATING DEVICE FOR ELECTRIC ARC LAMPS; P. Kassbauer, Vienna, Austria-Hungary. App. filed June 1, 1900. Details.

682,566. MECHANISM FOR REMOVING OR REPLACING SWITCHBOARD JACKS; W. S. Paca, Erie, Pa. App. filed Dec. 26, 1900. A tool for removing jacks from telephone switchboards comprising substantially a rod screw-threaded on one end so as to screw into a jack from the front of the switchboard and the jack moved back, thereby through the opening between the switchboard cables and returned through said opening to its place in the board.